# APPENDIX F

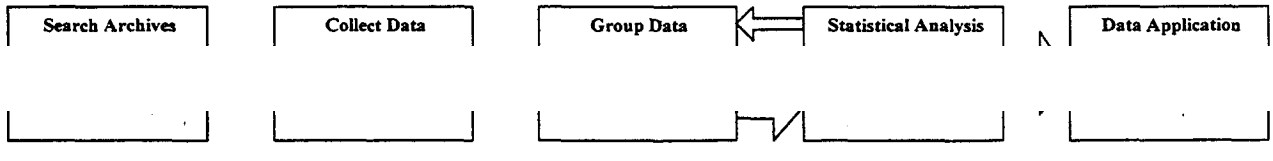
# DATA ANALYSIS AND RESULTS

# APPENDIX F

As described in Appendix C, essentially all of the constituent analytical data obtained during the search phase of the project was obtained from records at the FEMP. These data support development of data generalizations used to directly represent recycled uranium receipts at the FEMP from many of the key DOE uranium recycle sites and also cover many of the material types of interest for this project. The data is also directly applicable to FEMP shipments to other sites. This appendix describes the processes employed (both statistical and process knowledge) in analyzing the constituent data sub-groups to develop representative values for the many constituent mass flows in the FEMP data set. This appendix also addresses the application of the data to represent the other sites covered by this report. The ultimate use of this data, within this report, is to provide summary mass flows of constituents to and from the FEMP and the other sites included in this report.

## F.1 DATA SUB-GROUPS AND DATA USE BACKGROUND

As described in Appendix C, the FEMP analytical data was sub-grouped along logical chemistry and process and production stream lines to provide useful data categories. The sub-groups are identified in Table F.1-1. The sub-groups represent the result of several iterations of sub-group definitions. Initial sub-groups were defined and redefined based on the results of initial rounds of statistical evaluation and based on the determination of the need for additional precision in the definition of data sets. The initial 15 sub-groups were increased to 19 sub-groups to further segregate data into useful categories for application. One of the additional categories was created for A508 $UO_3$, materials from the Hanford PUREX process, to differentiate between materials that had potentially been combined with other sources of $UO_3$ at the FEMP and those that were purely representing "virgin" A508. In general sub-grouping has permitted segregation of the data along known biases.




One known bias that was not generally factored into data segregation is the period of production. Because FEMP analytical data primarily represents the production period from the middle to late 1980s, the use of the data for prior periods must be evaluated using available process knowledge. Application of the data using extrapolation is possible, but the limits of the applicability must be understood. Likewise,

the application of the resulting data to the other DOE sites covered by this report must be evaluated in the context of processing histories and available process knowledge, and inherent uncertainties must be noted. Section F.4, Application of Results to Material Streams, further discusses the approaches used to utilize results in a recycle constituents computational model which incorporates major process variations and best engineering judgement.

A related bias may exist for the entire data set, because of the non-random approach used to collect constituent data from the operations. Operations where higher levels of constituents were expected tended to have more data collected to facilitate tracking of constituents and permitting blending to meet targets. This phenomena seems to have been more prevalent for process streams internal to the FEMP than those that represent intersite shipments. The impact of the bias is effectively minimized by the careful segregation of materials into sub-groups and the application of adjustments for known process variances.

In several cases data sub-groups represent key data sets for the overall successful computation of constituent flows throughout the DOE. These data sub-groups are considered key data sets, due to the applicability of data from these sub-groups to other sites and because of the large quantities of recycled uranium that are represented by the data. One such data set is the A508 $UO_3$ from the Hanford PUREX process. This data sub-group was highly scrutinized to assure that only "virgin" material would be represented by the sub-group. FEMP processing of A508 often involved blending with other FEMP $UO_3$, so only the direct receipt materials were included in the data sub-group for "virgin" A508 (Sub-Group 6A). The remaining materials were categorized in separate sub-groups. This strategy also results in a data set that has more direct applicability for many of the other DOE sites that also received $UO_3$ from the Hanford PUREX operation.

FEMP receipts from the GDPs was also identified as a high impact data set. The flows of ash and scrap

application of constituent flows. These materials were known from the 1985 report on transuranic content in FEMP materials to be the source of a relatively large portion of FEMP recycle constituents receipts.

**TABLE F.1-1**

**FEMP DATA SUB-GROUP DEFINITIONS**

| Sub-Group Number | Sub-Group Title |
|---|---|
| 1A | Miscellaneous Materials |
| 1B | Miscellaneous Materials from Minor Off-Site Sources |
| 2 | $UF_4$ and Residues prepared from $UF_6$ Sources (GDP Tails) |
| 3 | $UF_6$ Source Metal & Scrap |
| 4 | Normal U Products, Residues, & Metal Scrap |
| 5 | U Intermediates and Products from Enriched $UF_6$ Sources |
| 6A | A508 $UO_3$ (PUREX Source – Unblended) |
| 6B | $UO_3$, $UF_4$ and Residues/Intermediates from A508 $UO_3$ (Low Cross-Over Potential) |
| 6C | $UO_3$, $UF_4$ and Residues/Intermediates from A508 $UO_3$ (High Cross-Over Potential) |
| 6D | A500 Coded Enriched Residues |
| 6E | Savannah River Source Uranyl Nitrate (PUREX)(Prior to Conversion to $UO_3$) |
| 6F | Savannah River $UO_3$ (Mark 15) (Not Shipped to FEMP) |
| 7A | Derbies prepared from A508 $UO_3$ (Potentially Blended) |
| 7B | Ingots/Other Metal prepared from A508 $UO_3$ (Potentially Blended) |
| 8 | Enriched $MgF_2$ |
| 9 | Incinerator Ash & Scrap Residues from GDPs |
| 10A | Tower Ash & Decontamination Residues |
| 10B | $UO_3$ Produced from Tower Ash Receipts |
| 11 | Waste Residues Lower than Economic Discard Limit (EDL) |

## F.2 STATISTICAL ANALYSIS APPROACH

Each of the data sets defined by the FEMP analytical database (Appendix C, Attachment 2) sub-groups (and categories within sub-groups) was first prepared for statistical analysis, including:

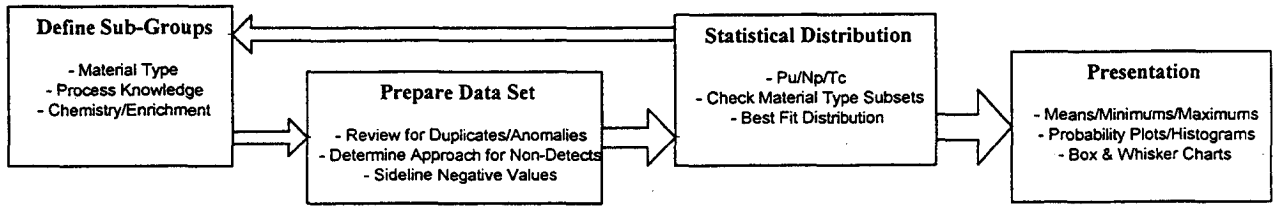
- Review of data sub-groups for duplicate records and other anomalies.
- Assessment "less than" values to determine statistically valid approaches for representing these values (detection limit was identified as a conservative approach).
- Elimination of negative values (the result of laboratory blanks detecting higher for a constituent than the sample) from evaluation.

Each of the data sets was reviewed from a statistics vantage point to determine its characteristics, including:

- Assessment of the statistical distribution of transuranic and fission product constituents (Pu-239 ppb U, Np-237 ppb U, and Tc-99 ppb U) data.

- Identification of an approach to represent each dataset (i.e. for normal distributions, the mean of the dataset could be adequate, however, for non-normal distributions other more advanced approaches are required) based on the distribution determined.

- Performance of supplemental relational checks of the data, such as the occurrence of correlation between various data values and the validity of extreme data points.




This review initially involved determining if the data set could be well represented by a normal or log-normal distribution, using Statgraphics© software to support the analysis. If a conformance to a normal or log-normal distribution were found, the data set could be represented by the either the mean or the log-mean for application in the constituent mass flow calculations model.

A further review of the data sub-groups was performed to verify that sub-elements of the defined data sub-group were consistent with the overall distribution of data. In general, this analysis evaluated whether the several material types that comprise many of the sub-groups were of consistent distributions. This sort of analysis was performed to create structured questions about data subsets rather than to be used as a decision basis. Upon inspection of data anomalies, several data subsets were found to belong in alternate data sub-groups, so the analysis did result in an improved data segregation.

## F.3 STATISTICAL ANALYSIS RESULTS

Analysis of the data sub-groups resulted in the determination that none of the constituent data sub-groups conform to pure a distribution. Although pure distributions (those that would conform well to normal or log-normal distributions) were desired and initially expected, the lack of conformance to a standard type of distribution is not uncommon and does not adversely affect application of the data. In all cases, the datasets were determined to be best represented by the use of a simple arithmetic average of the data values. The statistical evaluations performed on the data sub-groups have been provided by Attachment 1 to this appendix to illustrate the data sets and provide the values resulting from the analyses. Attachment 1 provides additional discussion on the presentation of the data and provides the specific outputs from the analysis of the data. Sub-group distribution plots (both quantile and histogram types) are provided in the attachment to illustrate the data set distributions, typically against a log-normal distribution assumption.

The results of the statistical analyses are provided in Table F.3-1, based on the information presented by Attachment 1.

**TABLE F.3-1**

**FEMP REPRESENTATIVE CONSTITUENT VALUES BY DATA SUB-GROUP**

| Sub-Group Number | Sub-Group (S/G) Title | Value for Pu-239 ppb U | Value for Np-237 ppb U | Value for Tc-99 ppb U |
|---|---|---|---|---|
| 1A | Miscellaneous | 16.035 | 1,328.11 | 2,399.22 |
| 1B | Miscellaneous – Minor Offsite | 0.889 | 109.07 | 0.55 |
| 2 | $UF_6$ Source $UF_4$ (GDP Tails) | 0.502 | 54.90 | 201.61 |
| 3 | $UF_6$ Source Metal & Scrap | 0.007 | 2.54 | 9.12 |
| 4 | Normal U Products, Res & Metal Scrap | 0.091 | 67.09 | 26.55 |
| 5 | Enriched $UF_6$ Source Products/Res. | 1.259 | 81.39 | 2,109.61 |
| 6A | $UO_3$ PUREX Source (A508)(Unblended) | 2.884 | 388.97 | 8,552.23 |
| 6B | A508 $UO_3/UF_4$ & Res. (Low Cross) | 2.321 | 332.94 | 8,934.58 |
| 6C | A508 $UO_3/UF_4$ & Res. (High Cross) | 23.969 | 1,045.29 | 2,789.56 |
| 6D | A500 Coded Enriched Residues | 4.556 | 143.75 | 1,085.45 |
| 6E | SR UNH | 16.527 | -- | -- |
| 6F | SR $UO_3$ – Not Shipped to FEMP | 2.805 | -- | -- |
| 7A | A508 based Derbies | 9.305 | 311.97 | 1,721.00 |
| 7B | A508 based Ingots & Metal | 1.165 | 263.48 | 447.81 |
| 8 | Enriched $MgF_2$ | 96.618 | 1,881.53 | 1,651.23 |
| 9 | Incinerator Ash & Scrap Res. From GDPs | 47.616 | 3164.53 | 263.32 |
| 10A | Tower Ash & Decon Res. | 412.177 | 10,503.53 | 2,618.36 |
| 10B | $UO_3$ from Tower Ash | 20.772 | 498.17 | 2,405.28 |
| 11 | Waste Residues <EDL | 84.817 | 3,999.32 | 4,110.05 |

Note: TBD = To be determined.

## F.4 APPLICATION OF RESULTS TO MATERIAL STREAMS

Application of the available FEMP analytical data to the identified recycled uranium mass flows has been accomplished in this report by a combination of direct application (data directly represents materials in question) and extrapolation (data is selected from available sub-groups to approximate the material in question) using process knowledge as a guide. This approach is further explained in this section. Since the FEMP data providing transuranic and fission product results primarily dates from the period following the receipt of Paducah Ash Campaign residues at the FEMP (see Appendix E, Attachment 2), the general representativeness of these data to prior site processing was unknown and suspect at the beginning of the investigation. Since a relatively small number of analytical values are utilized to represent approximately 40 years of Fernald shipments, receipts, and production and are also utilized to represent other DOE site

recycled uranium, the need for high confidence in the data sets was established early. Data confidence, as described here, is different from the data quality described in Appendix C. Data confidence describes the confidence that the data provided represents the materials for which the data is applied and that any conditions on the application of the data are understood with associated caveat. The need for high data confidence drove the development of the 19 sub-groups of data presented above in Table F.3-1 and further affected the development of the strategies for applying the data sub-group information to the various receipts and shipments for each of the sites.

The basic strategy for data application derives from the receipt and shipment information of Appendix A and Appendix B and the process knowledge of the major material types that are represented by the transactions. These transaction material types and recycled uranium flows are identified on the "bubble charts" in Appendix A and Appendix B. Table F.4-1, Representative Constituent Data for FEMP Shipments and Receipts, provides a crosswalk of the receipt and shipment sites and material types from the information of Appendix A and Appendix B. The rationale for selection of representative FEMP data sub-group results for each stream is also provided.

Unfortunately, FEMP receipt and shipment data are not currently reconstructed to a degree that will support segregation of the mass flows between the sites purely along material type lines. Generally receipt and shipment material types have not been resolved – for example, a shipment may have been uranium metal or might have been $UO_3$. Process knowledge of the typical intersite material transactions provided the best insight for selection of a normal material transaction and a best approximation for sub-group constituent data selection. In most cases, the transactions between the sites that were the norm (i.e. enriched metal to Hanford from the FEMP and RMI and enriched $UO_3$ (A508) back from Hanford) became the driver for the selection of a representative sub-group of the data. If future research reveals additional data or provides additional insight into individual material types, the constituent values used in the constituent mass flow calculation model could be modified for the respective category to yield a refined result. Results of the application of these data to mass flows is provided by section F.5.

In several cases, data from Table F.3-1 required refinement to apply to the full period of production (see Example #1)

In order to apply constituent values to the wide variety of material and waste streams encountered by the FEMP and the other sites represented in this report, interpretation of the available data must be performed. Tables F.4-1A through F.4-1D identify the data sub-group and data values (from Table F.3-1) to be utilized to represent each of the major recycle uranium material streams identified for each of the sites covered by this report. The table also provides an explanatory rationale for the choice of the data set, based on historical process knowledge. Tables F.4-2 provides similar information for current waste and product inventories for the FEMP. The other sites covered by this report have neither product or waste inventories remaining and their respective waste discards have been included under the shipments category.

**Example #1**

Over the production history of the FEMP, enriched metal for the Hanford "N" Reactor was recycled back to the FEMP both pre-reactor cycle and as $UO_3$ post reactor cycle. So-called "cold metal scrap" (which actually contained recycled uranium constituents after recycling began in the early 1960s) was returned to the FEMP from the variety of operations of metal preparation ahead of the reactor (extrusion mistakes, setup pieces, machining scraps, mechanical defects, etc.). The recycle constituents in these materials should precisely mirror the enriched metal product of the FEMP during any given time period. Generally, slight amounts of constituent decontamination occur during processing of A508 $UO_3$ and cold metal scrap through the FEMP and deliberate blending of fresh materials into the process also dilutes the recycle constituents in the products versus the original feed materials. However, following the introduction of Paducah scraps (Ash Campaign) in the 1980s, the FEMP struggled to blend off larger quantities of recycle constituents. The enriched metal produced from this era was significantly higher in constituent concentration than similar product prior to the campaign. In order to accurately reflect the average value for the Hanford metal stream, this post-1982 metal product (representing about 22% of total enriched metal production for Hanford) has been factored as an adjustment of the Hanford enriched metal constituent data value to develop a weighted average for better representing the constituent content of this metal stream.

The streams identified on these tables correspond to the major shipment and receipt categories identified from process knowledge and shipment records reviewed at the FEMP. Example #2 provides a discussion of the development of engineering and process knowledge rationale to address a shipment stream for which no directly applicable data was available. Application of FEMP data to the other sites covered in this report follows a similar approach.

**Example #2**

Essentially no data has been located to represent the uranyl nitrate received by the FEMP from the West Valley Site. The receipts represent "N" Reactor, commercial, and university reactor processing by the West Valley PUREX operation. Reasonable options for approximation of the receipt stream constituent content include the Hanford PUREX $UO_3$ data set (6A) and the Savannah River uranyl nitrate data set (6E). Although the Savannah River data is also the result of a PUREX operation, the data set is severely limited and appears to represent a non-typical processing campaign. The Hanford data set is extensive and appears to represent the capabilities of the PUREX process for scavenging plutonium from the uranium stream. Therefore data sub-group 6A was chosen to represent the entire uranyl nitrate shipment legacy from West Valley to the FEMP.

## TABLE F.4-1A REPRESENTATIVE CONSTITUENT DATA FOR FEMP RECEIPTS AND SHIPMENTS

| Stream | | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|---|
| **RECEIPTS** | | | | | | |
| **Enriched Receipts** | | | | | | |
| Hanford | UO3 (A508) | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.33 | Data sub-group specifically aligned to this material. |
| Hanford | UO2 | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| Hanford | U3O8 | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| Hanford | Cold Metal Scrap | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| Hanford | Process Residues | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| RMI | U3O8 | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| RMI | Metal Scrap | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| RMI | Process Residues | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| West Valley | UNH | Single Data Point | 3.947 | 139.0 | 3155.1 | A single data point of FEMP UF4 that used WV UNH as feed source was selected to represent the WV stream (H029-732-0-210-0285). |
| NUMEC (CAP) | UNH | Single Data Point | 3.947 | 139.0 | 3155.1 | A single data point of FEMP UF4 that used WV UNH as feed source was selected to represent the WV stream (H029-732-0-210-0285). |
| Portsmouth | U3O8 | S/G 10A, Tower Ash + | 412.177 | 10503.53 | 2618.36 | Stream assumed mostly derived from decontamination activities at PORTS and resembles Tower Ash in constituent content. |
| Portsmouth | UF6 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available, but expect low values. Use Normal data to represent, since S/G 4 heavily influenced by UF6 content. |
| Portsmouth | UNH | S/G 10A, Tower Ash + | 412.177 | 10503.53 | 2618.36 | Stream may have derived from the decontamination activities at PORTS and resembles Tower Ash in constituent content. |
| Savannah River | UO3 | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | Relates to early 0.86 E stream tied to PNUR program. Possibly a blend, so over-represented by A508. |
| Savannah River | UNH | S/G 6E, SR UNH | 16.527 | -- | -- | Higher than A508 due to nature of reactor program. |
| Savannah River | Cold Metal Scrap | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |

| Stream | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|
| | | | | | Calculation is based on Hanford enriched metal. |
| Oak Ridge (K-25) UO2 | S/G 9, Incinerator Ash | 47.616 | 3164.53 | 263.32 | Expected to resemble Paducah Incinerator Ash, which is represented by the data of S/G 9. |
| Oak Ridge (K-25) U3O8 (Incinerator Ash) | S/G 9, Incinerator Ash | 47.616 | 3164.53 | 263.32 | Expected to resemble Paducah Incinerator Ash, which is represented by the data of S/G 9. |
| Oak Ridge (K-25) UNH | S/G 10A, Tower Ash + | 412.177 | 10503.53 | 2618.36 | Expected to resemble Paducah Tower Ash, which is represented by the data of S/G 10. |
| Oak Ridge (K-25) UF?(Tower Ash) | S/G 10A, Tower Ash + | 412.177 | 10503.53 | 2618.36 | Expected to resemble Paducah Tower Ash, which is represented by the data of S/G 10. |
| Oak Ridge (K-25) UF6 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available, but expect low values. Use Normal data to represent, since S/G 4 heavily influenced by UF6 content. |
| Oak Ridge (Y-12) UO2 | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | Default value - material not well documented. |
| Oak Ridge (Y-12) U3O8 | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | Default value - material not well documented. |
| Paducah UO3 (A508) | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | Data sub-group specifically aligned to this material. Trans-shipped Hanford material. |
| Paducah UF6 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available, but expect low values. Use Normal data to represent, since S/G 4 heavily influenced by UF6 content. |
| Paducah U3O8 (Incinerator Ash) | S/G 9, Incinerator Ash | 47.616 | 3164.53 | 263.32 | Data sub-group specifically aligned to this material. |
| Paducah Feed Plant Ash/Tower Ash | S/G 10A, Tower Ash + | 412.177 | 10503.53 | 2618.36 | Data sub-group specifically aligned to this material. |
| Paducah Process Residues | S/G 9, Incinerator Ash | 47.616 | 3164.53 | 263.32 | Data sub-group specifically aligned to this material. |
| Weldon Spring UO3 | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | No breakout data available. No GDP ash or decontamination residues are expected to occur in these materials. Use S/G 6A as default. |
| Weldon Spring Metal Dingots | S/G 7B, A508 Ingots and Metal | 1.165 | 263.48 | 447.81 | No breakout of data available – Use S/G 7B since Fernald receipts of metal from Weldon Spring was prior to the introduction of high constituent GDP ash into complex. |
| Weldon Spring Metal Scrap | S/G 7B, A508 Ingots and Metal | 1.165 | 263.48 | 447.81 | No breakout of data available – Use S/G 7B since Fernald receipts of metal from Weldon Spring was prior to the introduction of high constituent GDP ash into complex. |
| Weldon Spring Process Residues | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | No breakout of data available - Use S/G 6A data. Values for A508 UO3 would be expected. |
| Other DOE Sites (ANL) U3O8 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Assume a UF6 based source for the materials. Use DU data as close, but conservative. |
| Other DOE Sites (MEMP) U3O8 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Assume a UF6 based source for the materials. Use DU data as close, but conservative. |

| Stream | | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|---|
| Other DOE Sites (Bettis) | UO2 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Assume a UF6 based source for the materials. Use DU data as close, but conservative. |
| Other DOE Sites (Ames) | UO2 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Assume a UF6 based source for the materials. Use DU data as close, but conservative. |
| Other DOE Sites (Rockwell) | UO2 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Assume a UF6 based source for the materials. Use DU data as close, but conservative. |
| Other DOE Sites (Chicago) | UO2 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Assume a UF6 based source for the materials. Use DU data as close, but conservative. |
| Other DOE Sites (Idaho) | UO2 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Assume a UF6 based source for the materials. Use DU data as close, but conservative. |
| Other DOE Sites (ORNL) | UO2 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Assume a UF6 based source for the materials. Use DU data as close, but conservative. |
| Other DOE Sites (B&W) | UO2 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Assume a UF6 based source for the materials. Use DU data as close, but conservative. |
| Other DOE Sites (Pitt) | UO2 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Assume a UF6 based source for the materials. Use DU data as close, but conservative. |
| **Normal Receipts** | | | | | | |
| Hanford | Cold Metal Scrap | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Most pre-dates RU, was natural, or was UF6 derived. No breakout of data available. Use S/G 4, which is influenced by UF6. |
| Hanford | Process Residues | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Most pre-dates RU, was natural, or was UF6 derived. No breakout of data available. Use S/G 4, which is influenced by UF6. |
| RMI | Cold Metal Scrap | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Most pre-dates RU, was natural, or was UF6 derived. No breakout of data available. Use S/G 4, which is influenced by UF6. |
| RMI | Process Residues | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Most pre-dates RU, was natural, or was UF6 derived. No breakout of data available. Use S/G 4, which is influenced by UF6. |
| Paducah | UO3 | No Constituent Content | 0 | 0 | 0 | Probably from ore concentrates. |
| Paducah | UF4 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Most pre-dates RU, was natural, or was UF6 derived. No breakout of data available. Use S/G 4, which is influenced by UF6. |
| Oak Ridge (K-25) | UF6 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Most pre-dates RU, was natural, or was UF6 derived. No breakout of data available. Use S/G 4, which is influenced by UF6. |
| Portsmouth | UF6 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Most pre-dates RU, was natural, or was UF6 derived. No breakout of data available. Use S/G 4, which is influenced by UF6. |
| Niagara Falls | K-65 Residues | No Constituent Content | 0 | 0 | 0 | Prior to RU. |
| Weldon Spring | Process Residues | No Constituent Content | 0 | 0 | 0 | Weldon's Normal stream not expected to contain RU. |
| Weldon Spring | Ore Concentrates | No Constituent Content | 0 | 0 | 0 | Weldon's Normal stream not expected to contain RU. |
| Weldon Spring | Airport Scrap | No Constituent Content | 0 | 0 | 0 | Weldon's Normal stream not expected to contain RU. |

| Stream | | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|---|
| Weldon Spring | Metal Dingots | No Constituent Content | 0 | 0 | 0 | Weldon's Normal stream not expected to contain RU. |
| Grand Junction | Ore | No Constituent Content | 0 | 0 | 0 | No potential for RU from this site at this time. |
| Grand Junction | Ore Concentrates | No Constituent Content | 0 | 0 | 0 | No potential for RU from this site at this time. |
| Savannah River | Cold Metal Scrap | No Constituent Content | 0 | 0 | 0 | Earliest operations. No RU content. |
| Port Hope (Canada) | UO3 | No Constituent Content | 0 | 0 | 0 | Prior to RU. |
| **Depleted Receipts** | | | | | | |
| Hanford | Cold Metal Scrap | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| RMI | Extruded Tubes | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| RMI | Metal Scrap | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| RMI | U3O8 | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | These materials were derived from Depleted Metal (see above). |
| RMI | Residues | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | These materials were derived from Depleted Metal (see above). |
| Paducah | UF4 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Depleted stream UF6 and UF4 from UF6 have trace constituent levels, but differs slightly from depleted metal. |
| Paducah | UF6 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Depleted stream UF6 and UF4 from UF6 have trace constituent levels, but differs slightly from depleted metal. |
| Paducah | UO3 | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | Assumes near normal isotopic and related to 1970s Paducah Scrap Campaign - A508 that potentially under-represents, but no other clear data set. |
| Paducah | Residues | S/G 9, Incinerator Ash | 47.616 | 3164.53 | 263.32 | Assumes that these materials were low U content, but potentially constituent containing. |
| Oak Ridge (K-25) | UF6 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Depleted stream UF6 and UF4 from UF6 have trace constituent levels, but differs slightly from depleted metal. |
| Savannah River | Cold Metal Scrap | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Savannah River | UO3 | S/G 6F, SR UO3 | 2.805 | -- | -- | The SR UO3 was somewhat similar to the A508 stream (S/G 6A), but unlike SR UNH, which was derived from higher enriched feeds. |
| Other Federal Agencies | Scrap Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |

## SHIPMENTS

| Stream | | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|---|
| **Enriched Shipments** | | | | | | |
| Hanford | Cores | S/G 7B, A508 Ingots and Metal | 1.165 | 263.48 | 447.81 | No breakout of data available – Use S/G 7B since Fernald shipments of metal directly to Hanford were stopped in early 1970s prior to the processing of Paducah Ash by Fernald Refinery. |
| RMI | NPR Ingots | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| Oak Ridge (K-25) | UNH | No Constituent Content | 0 | 0 | 0 | Predates RU issues. |
| Portsmouth | U3O8 | S/G 6E, SR UNH | 16.527 | -- | -- | Higher enriched derived from SR UNH. |
| Portsmouth | UF6 | S/G 5, Enriched from UF6 | 1.259 | 81.39 | 2109.61 | Data sub-group specifically aligned to this material. |
| Savannah River | Cores | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| Paducah | UO3 | S/G 10B, UO3 from GDP Ash | 20.772 | 498.17 | 2405.28 | Results of Paducah Scrap Campaign through FEMP Refinery. Data S/G specifically designed to segregate these materials into a category. |
| Paducah | UF4 | S/G 10B, UO3 from GDP Ash | 20.772 | 498.17 | 2405.28 | Assumes related to above Paducah Scrap Campaign through FEMP Refinery. |
| Paducah | UF6 | S/G 5, Enriched from UF6 | 1.259 | 81.39 | 2109.61 | Data sub-group specifically aligned to this material. |
| Weldon Spring | UO3 | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | No breakout of data available - Use S/G 6A data to reflect probable enriched stream constituent content from time period. Would overestimate, if enriched was UF6 source. |
| Weldon Spring | Metal Scrap | S/G 7B, A508 Ingots and Metal | 1.165 | 263.48 | 447.81 | No breakout of data available – Use S/G 7B since Fernald shipments of metal to Weldon Spring were prior to the processing of Paducah Ash by Fernald Refinery. |
| Weldon Spring | Residues | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | No breakout of data available - Use S/G 6A data to reflect probable enriched stream constituent content from time period. Would overestimate, if enriched was UF6 source. |
| **Normal Shipments** | | | | | | |
| Hanford | Cores | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available, but expect low values. Use Normal data to represent, since S/G 4 heavily influenced by UF6 content. |
| RMI | NPR Ingots | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available, but expect low values. Use Normal data to represent, since S/G 4 heavily influenced by UF6 content. |
| Savannah River | Cores | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available, but expect low values. Use Normal data to represent, since S/G 4 heavily influenced by UF6 content. |
| Oak Ridge (K-25) | UF6 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available, but expect low values. Use Normal data |

| Stream | | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|---|
| | | | | | | to represent, since S/G 4 heavily influenced by UF6 content. |
| Paducah | UO3 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available, but expect low values. Use Normal data to represent, since S/G 4 heavily influenced by UF6 content. |
| Paducah | UF4 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available, but expect low values. Use Normal data to represent, since S/G 4 heavily influenced by UF6 content. |
| Portsmouth | U Metal (to UMC) | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Final runs of Normal metal ~90% from UF6. |
| Portsmouth | UF4 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Final runs of Normal metal ~90% from UF6. |
| Weldon Spring | UO3 | No Constituent Content | 0 | 0 | 0 | Expected to predate RU and be in an unrelated isotopic range for the period. |
| Weldon Spring | Metal | No Constituent Content | 0 | 0 | 0 | Expected to predate RU and be in an unrelated isotopic range for the period. |
| Weldon Spring | Residues | No Constituent Content | 0 | 0 | 0 | Expected to predate RU and be in an unrelated isotopic range for the period. |
| Other Federal Agencies | Misc | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available - Use S/G 4 data. |
| **Depleted Shipments** | | | | | | |
| RMI | NPR Ingots | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| RMI | SR Ingots | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Savannah River | Target Elements | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Oak Ridge (Y-12) | Derby Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Paducah | UF6 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Depleted stream UF6 and UF4 from UF6 has trace constituent levels, but differs slightly from depleted metal. |
| Paducah | UO3 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Depleted stream UF6 and UF4 from UF6 has trace constituent levels, but differs slightly from depleted metal. |
| Paducah | UF4 | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Depleted stream UF6 and UF4 from UF6 has trace constituent levels, but differs slightly from depleted metal. |
| Portsmouth | UF4 (to UMC) | S/G 2, Depleted UF6 based UF4 | 0.502 | 54.90 | 201.61 | Depleted stream UF6 and UF4 from UF6 has trace constituent levels, but differs slightly from depleted metal. |
| Rocky Flats | Derby Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Rocky Flats | Flat Ingots | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU |

| Stream | | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|---|
| | | | | | | constituents present. The INEEL data (S/G 3) would be representative. |
| Other DOE Sites | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Other DOE Sites | Compounds | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Other Federal Agencies | Penetrator Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Other Federal Agencies | Metal Shapes | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |

## TABLE F.4-1B REPRESENTATIVE CONSTITUENT DATA FOR RMI RECEIPTS AND SHIPMENTS

| Stream | | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|---|
| **RECEIPTS** | | | | | | |
| **Enriched Receipts** | | | | | | |
| Fernald | Metal | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| Hanford | Metal Scrap | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| **Normal Receipts** | | | | | | |
| Fernald | Metal | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Assume similar to FEMP Normal data, though it is heavily influenced by UF6 source. |
| Hanford | Metal | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Assume similar to FEMP Normal data, though it is heavily influenced by UF6 source. |
| **Depleted Receipts** | | | | | | |
| Fernald | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Oak Ridge (Y-12) | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Rocky Flats | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Savannah River | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Port Hope (Canada) | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| DOD Program | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |

| Stream | | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|---|
| **SHIPMENTS** | | | | | | |
| **Enriched Shipments** | | | | | | |
| Fernald | Metal | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| Hanford | Metal | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| LLNL | Metal | FEMP Enriched Metal Calculation | 4.297 | 372.03 | 7049.36 | No breakout of data available - Use 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| **Normal Shipments** | | | | | | |
| Fernald | Metal | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Assume similar to FEMP Normal data, though it is heavily influenced by UF6 source. |
| Hanford | Metal | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Assume similar to FEMP Normal data, though it is heavily influenced by UF6 source. |
| **Depleted Shipments** | | | | | | |
| Fernald | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Hanford | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Oak Ridge (Y-12) | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Rocky Flats | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Port Hope (Canada) | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| DOD Program | Metal | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |

## TABLE F.4-1C REPRESENTATIVE CONSTITUENT DATA FOR WEST VALLEY SHIPMENTS

| Stream | | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|---|
| **SHIPMENTS** | | | | | | |
| **Enriched Receipts** | | | | | | |
| Fernald | Uranyl Nitrate | Single Data Point | 3.947 | 139.0 | 3155.1 | A single data point of FEMP UF4 that used WV UNH as feed source was selected to represent the WV stream (H029-732-0-210-0285). |
| Y-12 | Uranyl Nitrate | Single Data Point | 3.947 | 139.0 | 3155.1 | A single data point of FEMP UF4 that used WV UNH as feed source was selected to represent the WV stream (H029-732-0-210-0285). |

## TABLE F.4-1D REPRESENTATIVE CONSTITUENT DATA FOR WELDON SPRING RECEIPTS AND SHIPMENTS

| Stream | | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|---|
| **RECEIPTS** | | | | | | |
| **Enriched Receipts** | | | | | | |
| Fernald | UO3, Metal, Scrap, Residues | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | No breakout of data available - Use S/G 6A data to reflect probable enriched stream constituent content from time period. Would overestimate, if enriched was UF6 source. |
| Other DOE Sites | UF6, UF4 | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | No breakout of data available - Use S/G 6A data to reflect probable enriched stream constituent content from time period. Would overestimate, if enriched was UF6 source. |
| **Normal Receipts** | | | | | | |
| Fernald | UO3, Metal, Scrap, Residues | No Constituent Content | -- | -- | -- | Weldon records indicate all site normal was "Natural" |
| Other DOE Sites | Ore Concentrates, Ore | No Constituent Content | -- | -- | -- | Weldon records indicate all site normal was "Natural" |
| **Depleted Receipts** | | | | | | |
| Fernald | UO3, Metal, Scrap, Residues | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Other DOE Sites | UF6, UF4 | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| **SHIPMENTS** | | | | | | |
| **Enriched Shipments** | | | | | | |
| Fernald | UO3, Metal Residues | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | No breakout of data available - Use S/G 6A data to reflect probable |
| Other DOE Sites | | S/G 6A, A508 UO3 | 2.884 | 388.97 | 8552.23 | No breakout of data available - Use S/G 6A data to reflect probable enriched stream constituent content from time period. Would overestimate, if enriched was UF6 source. |
| **Normal Shipments** | | | | | | |
| Fernald | Process Residues, | No Constituent Content | -- | -- | -- | Weldon records indicate all site normal was "Natural" |

| Stream | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|
| Ore Concentrates, Airport Scrap, Metal Dingots | | | | | |
| Other DOE Sites | No Constituent Content | -- | -- | -- | Weldon records indicate all site normal was "Natural" |
| **Depleted Shipments** | | | | | |
| Fernald | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Other DOE Sites | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |

## TABLE F.4-2 REPRESENTATIVE CONSTITUENT DATA FOR FEMP WASTE AND PRODUCT INVENTORY

| Stream | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|
| **FEMP INVENTORY (As of March 31, 1999)** | | | | | |
| **Nuclear Materials - Enriched** | | | | | |
| Metals | | | | | |
| 1.25% Derbies | S/G 7A | 9.305 | 311.97 | 1721.00 | Enriched derbies from A508 residues. S/G 7A includes both 1.25% and 0.95% derbies. |
| 0.95% Ingots | S/G 7A | 9.305 | 311.97 | 1721.00 | Enriched derbies from A508 residues. S/G 7A includes both 1.25% and 0.95% derbies. |
| 1.25% Ingots | S/G 7A | 9.305 | 311.97 | 1721.00 | Enriched derbies from A508 residues. S/G 7A includes both 1.25% and 0.95% derbies. |
| <1.00% Recycle | S/G 7A | 9.305 | 311.97 | 1721.00 | Enriched derbies from A508 residues. S/G 7A includes both 1.25% and 0.95% derbies. |
| >1.00% Recycle | S/G 7A | 9.305 | 311.97 | 1721.00 | Enriched derbies from A508 residues. S/G 7A includes both 1.25% and 0.95% derbies. |
| Compounds | | | | | |
| U3O8 | S/G 6C | 23.969 | 1045.29 | 2789.56 | No breakout of data available - Use S/G 6C data since these residues are likely to be left over from Paducah Tower Ash UO3 campaigns. |
| UO2 | S/G 6C | 23.969 | 1045.29 | 2789.56 | No breakout of data available - Use S/G 6C data since these residues are likely to be left over from Paducah Tower Ash UO3 campaigns. |
| 0.82 - 1.00% UO3 | S/G 10B, UO3 from Tower Ash | 20.772 | 498.17 | 2405.28 | Results of UO3 from Tower Ash Campaign through FEMP Refinery. Data from Incinerator Ash group should be best fit from data set due to Refinery blending. |
| >1.00 - 1.25% UO3 | S/G 10B, UO3 from Tower Ash | 20.772 | 498.17 | 2405.28 | Results of UO3 from Tower Ash Campaign through FEMP Refinery. Data from Incinerator Ash group should be best fit from data set due to Refinery blending. |
| 0.72-1.00% UF4 | S/G 6C | 23.969 | 1045.29 | 2789.56 | No breakout of data available - Use S/G 6C data since these residues are likely to be left over from Paducah Tower Ash UO3 campaigns. |
| >1.00 - 2.00 UF4 | S/G 6C | 23.969 | 1045.29 | 2789.56 | No breakout of data available - Use S/G 6C data since these residues are likely to be left over from Paducah Tower Ash UO3 campaigns. |
| Recoverable Residues | | | | | |
| <1.00% Recoverable Residues | S/G 6C | 23.969 | 1045.29 | 2789.56 | No breakout of data available - Use S/G 6C data since these residues are likely to include a significant amount blended A-508 UO3 and residues resulting from latter year production. This |
| [illegible] Residues | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] significant amount blended A-508 UO3 and residues resulting from latter year production. This S/G likely over represents the level of constituents in this stream |
| **Nuclear Materials - Normal** | | | | | |
| Metals | | | | | |
| Derbies | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Final runs of Normal metal ~90% from UF6. |

| Stream | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|
| Ingots/Cores | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Final runs of Normal metal ~90% from UF6. |
| Recycle | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Final runs of Normal metal ~90% from UF6. |
| Compounds | | | | | |
| UO3 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Final runs of Normal metal ~90% from UF6. |
| UF4 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Final runs of Normal metal ~90% from UF6. |
| **Nuclear Materials - Depleted** | | | | | |
| Metals | | | | | |
| MK31 Derbies | S/G 3, Depleted Metal | 0.007 | 2.55 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| MK31 Ingots | S/G 3, Depleted Metal | 0.007 | 2.55 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Cores | S/G 3, Depleted Metal | 0.007 | 2.55 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Recycle | S/G 3, Depleted Metal | 0.007 | 2.55 | 9.12 | Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Compounds | | | | | |
| UF4 | S/G 2, Depleted UF6/UF4 | 0.502 | 54.90 | 201.61 | Depleted stream UF6 and UF4 from UF6 has trace constituent levels, but differs slightly from depleted metal. |
| **Wastes - Enriched** | | | | | |
| Miscellaneous TSCA and Mixed Wastes | FEMP Enriched Metal | 4.297 | 372.03 | 7049.36 | No breakout of data available – TSCA/Mixed Wastes resulting from enriched metal operations best represented by using 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| Contaminated Trash/Debris | FEMP Enriched Metal | 4.297 | 372.03 | 7049.36 | No breakout of data available – TSCA/Mixed Wastes resulting from enriched metal operations best represented by using 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| Contaminated Copper | S/G 2, Depleted UF6/UF4 | 0.055 | 32.2 | 16.69 | Depleted stream UF6 and UF4 from UF6 has trace constituent levels, but differs slightly from depleted metal. Copper from GDP upgrades. |
| Contaminated Soils/Misc. Samples | FEMP Enriched Metal | 4.297 | 372.03 | 7049.36 | No breakout of data available – Contaminated soils and samples resulting from enriched metal operations best represented by using 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| Containerized Pit Waste | S/G 6D | 4.556 | 143.75 | 1085.45 | No breakout of data available - Use S/G 6D data. Results approximate the constituent level expected in enriched waste pit materials since waste pit disposal took place prior to Paducah |

| Stream | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|
| | | | | | Tower Ash campaign. |
| Miscellaneous Liquids | FEMP Enriched Metal | 4.297 | 372.03 | 7049.36 | No breakout of data available – Contaminated soils and samples resulting from enriched metal operations best represented by using 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| U Metal (Wastes) | FEMP Enriched Metal | 4.297 | 372.03 | 7049.36 | No breakout of data available – Enriched U metal (waste) resulting from enriched metal operations best represented by using 78% S/G 6A data plus 22% S/G 7A data to reflect historical split pre and post Paducah Ash Campaign. |
| UO3 | S/G 6C, UO3 and Residues | 23.969 | 1045.29 | 2789.56 | Enriched UO3 wastes are well represented by S/G 6C |
| UO2 | S/G 6C, UO3 and Residues | 23.969 | 1045.29 | 2789.56 | Enriched UO3 wastes are well represented by S/G 6C |
| U3O8 | S/G 6C, UO3 and Residues | 23.969 | 1045.29 | 2789.56 | Enriched U3O8 wastes are well represented by S/G 6C |
| UF4 | S/G 6C, UO3 and Residues | 23.969 | 1045.29 | 2789.56 | Enriched UF4 wastes are well represented by S/G 6C |
| MgF2 | S/G 8, MgF2 | 96.618 | 1881.53 | 1651.23 | Enriched MgF2 are well represented by S/G 8 |
| **Wastes - Normal** | | | | | |
| Miscellaneous TSCA and Mixed Wastes | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available – TSCA/Mixed Wastes resulting from normal operations most likely was originally based on normal U products, residues, and scrap. |
| Contaminated Trash/Debris | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available – Contaminated trash/debris resulting from normal operations most likely was originally based on normal U products, residues, and scrap. |
| Contaminated Copper | S/G 2, Depleted UF6/UF4 | 0.502 | 54.90 | 201.61 | Depleted stream UF6 and UF4 from UF6 have trace constituent levels, but differs slightly from depleted metal. Copper from GDP upgrades. |
| Contaminated Soils/Misc. Samples | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available – Contaminated soils/soil samples resulting from normal operations most likely was originally based on normal U products, residues, and scrap. |
| Containerized Pit Waste | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available – Containerized pit wastes resulting from normal operations most likely was originally based on normal U products, residues, and scrap. |
| Miscellaneous Liquids | S/G 4, Normal | 0.091 | 67.09 | 26.55 | No breakout of data available – Miscellaneous liquids resulting from normal operations most likely was originally based on normal U products, residues, and scrap. |
| U Metal (Wastes) | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Normal U metal wastes are well represented by S/G 4. |
| UO3 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Normal UO3 wastes are well represented by S/G 4. |
| UO2 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Normal UO2 wastes are well represented by S/G 4. |
| U3O8 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Normal U3O8 wastes are well represented by S/G 4. |
| UF4 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Normal UF4 wastes are well represented by S/G 4. |
| MgF2 | S/G 4, Normal | 0.091 | 67.09 | 26.55 | Normal MgF2 wastes are well represented by S/G 4. |

| Stream | Data Source | Representative Values Pu-239 (ppbU) | Np-237 (ppbU) | Tc-99 (ppbU) | Explanation |
|---|---|---|---|---|---|
| **Wastes - Depleted** | | | | | |
| Miscellaneous TSCA and Mixed Wastes | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | No breakout of data available – TSCA/Mixed Wastes resulting from depleted operations most likely was originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Contaminated Trash/Debris | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | No breakout of data available – Contaminated trash/debris resulting from depleted operations most likely was originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Contaminated Copper | S/G 2, UF6 Source UF4 | 0.502 | 54.90 | 201.61 | No breakout of data available – Copper from GDP upgrades. The UF6 source UF4 best represents this material. |
| Contaminated Soils/Misc. Samples | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | No breakout of data available – Contaminated soils and miscellaneous residues from depleted operations most likely was originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Containerized Pit Waste | S/G 2, UF6 Source UF4 | 0.502 | 54.90 | 201.61 | No breakout of data available – Contaminated soils and miscellaneous residues from depleted operations most likely was originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| Miscellaneous Liquids | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | No breakout of data available – Miscellaneous liquids resulting from depleted operations most likely was originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| U Metal (Wastes) | S/G 3, Depleted Metal | 0.007 | 2.54 | 9.12 | No breakout of data available - Depleted metal was all originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| UO3 | S/G 2, UF6 Source UF4 | 0.502 | 54.90 | 201.61 | No breakout of data available – Depleted UO3 residues categorized as waste were most likely collected during Safe Shutdown program. The operations most likely were originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| U3O8 | S/G 2, UF6 Source UF4 | 0.502 | 54.90 | 201.61 | No breakout of data available – Depleted U3O8 residues categorized as waste were most likely collected during Safe Shutdown program. The operations most likely were originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| UF4 | S/G 2, UF6 Source UF4 | 0.502 | 54.90 | 201.61 | No breakout of data available – Depleted UF4 residues categorized as waste were most likely collected during Safe Shutdown program. The operations most likely were originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |
| MgF2 | S/G 2, UF6 Source UF4 | 0.502 | 54.90 | 201.61 | No breakout of data available – Depleted MgF2 were most likely containerized during Safe Shutdown program. The operations most likely were originally based in UF6, but w/traces of RU constituents present. The INEEL data (S/G 3) would be representative. |

## F.5 CONSTITUENT MASS FLOWS

One of the fundamental goals of the Recycled Uranium Project is to summarize constituent mass flows between the various sites within and outside of the DOE. To achieve this goal, the constituent values by material stream data provided by the previous section and the data from uranium shipment and receipt information (Appendix A and Appendix B) are combined (in a summary fashion) in the tables below.

### F.5.1 FEMP

Tables F.5-1A and F.5-1B provide overall calculated constituent mass flows for FEMP receipts and shipments by isotopic range by site. These tables utilize the constituent values delineated in Table F.4-1A to allow the calculation of calculated constituent masses not only by site, but also by compound. In some instances, material flows between sites must be represented by constituent values that have been derived by combining one a more of the sub-groups that have no obvious direct connection to the material to be represented. This practice is necessary due to the lack of ability to quantify the quantity of a material type that was shipped to or received from a site. In completing the extrapolation of combined constituent values, the DOE Ohio Field Office Recycled Uranium Project Report team utilized process knowledge and best engineering judgement.

Table F.5-1A shows that Fernald received approximately 246,686 MTU of recycled uranium between 1962 and 1989. These receipts were comprised of approximately 25% enriched materials, 36% normal materials, and 39% depleted materials. The calculated constituent mass of Pu-239, Np-237, and Tc-99 for these recycled receipts is 217.7 g, 25,741.9 g, and 331,997.5 g respectively. Analyses of these calculated constituent masses indicate that the majority of the constituents of concerns were transported to the Fernald site in enriched receipts. For example, 207.8 g of the 217.7 g of calculated Pu-239 received by Fernald (~95%) came via enriched receipts. Further analyses indicate that RMI metal shipments, Paducah Incinerator Ash and Tower Ash, and Hanford metal and $UO_3$ shipments account for approximately 80% of the calculated Pu-239 received by Fernald.

Table F.5-1B shows that Fernald shipped approximately 249,229.6 MTU of recycled uranium between 1962 and 1999. These shipments were comprised of approximately 25% enriched materials, 38% normal materials, and 37% depleted materials. The calculated constituent mass of Pu-239, Np-237, and Tc-99 for

these recycled receipts is 191.1 g, 26,877.9 g, and 337,489.5 g respectively. As with the Fernald receipts, the enriched shipments account for the majority of the site's constituents of concern shipments. For example, 180.9 g of the 191.1 g of Pu-239 (~95%) was accounted for in Fernald enriched shipments.

Figures F.5-1A through F.5-1F provide a graphical summary of calculated FEMP receipts and shipments of recycle constituents by isotopic levels. These charts reflect the values from Table F.5-1A and F.5-1B.

Table F.5-1C provides calculated constituent masses for the FEMP nuclear materials inventory as of March 31, 1999. The calculation method is similar to that described above and indicates that roughly 15.2 g of Pu-239, 628 g of Np-237, and 2,172.5 g of Tc-99 can be accounted for in this nuclear materials inventory.

Similarly, Table F.5-1D provides calculated constituent masses for the FEMP waste inventory as of March 31, 1999. The calculation method is similar to that described above and indicates that an additional 7.4 g of Pu-239, 359.7 g of Np-237, and 1,920.8 g of Tc-99 is calculated to be in this waste inventory.

F.5.2 RMI

Tables F.5-2A and F.5-2B present the calculated constituent masses for the RMI site. These tables indicate that RMI received and shipped slightly less than 110 g of Pu-239, approximately 9,800 g of Np-237, and just over 178,000 g of Tc-99 during its recycled uranium operational history. As with Fernald, the >95% of the constituents of concern are attributable to the enriched streams.

F.5.3 WVDP

Table F.5-3 presents the calculated constituent masses for the shipments of recycled uranium from the West Valley site. Since the West Valley site performed uranium and plutonium recovery operations from irradiated fuels, no recycled uranium, per Project definition, was received at West Valley. All West Valley shipments were made to either Fernald or to the Y-12 Plant in Oak Ridge. Based on the data available, it has been calculated that West Valleys' shipments of 619.4 MTU of recycled uranium contained 2.4 g of Pu-239, 86.1 g of Np-237, and 1,954.3 g of Tc-99.

F.5.4 WSSRAP

Tables F.5-4A and F.5-4B present the calculated constituent masses for the Weldon Spring site. Since the Weldon Spring site primarily operated using "natural" uranium from ore and ore concentrates, the quantity of constituents of concern is minimal when compared to Fernald. Essentially all of the constituents of concern received and shipped by the Weldon Spring site were associated with the limited quantity of enriched materials the site handled. Based on available historical receiving and shipping records, the Weldon Spring site handled approximately 840 MTU of enriched recycled uranium (~1% of the total material handled). In this enriched stream, the calculated constituent masses for Pu, Np, and Tc are 2.4 g, 325 g, and 7,200 g respectively with the majority of these constituents flowing between Weldon Spring and Fernald.

F.5.5 ENVIRONMENTAL RELEASES

Table F.5-5 present calculated constituent masses for environmental releases from all four sites addressed by the DOE Ohio Field Office Recycled Uranium Report. This table was compiled using best engineering judgement to select constituent values and is based on information/data presented in Appendix E concerning the site's historical environmental releases. It is important to note that RMI has indicated that they had no significant environmental releases during the facility's operational period and that West Valley's environmental releases were not comprised of recycled uranium and therefore, not the subject of this report.

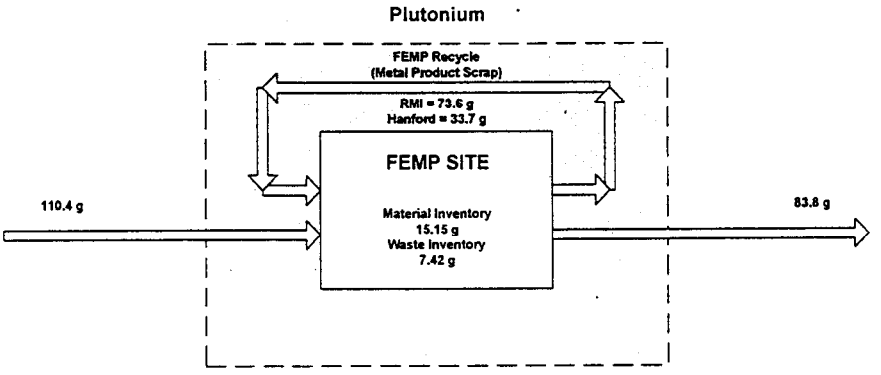
F.6 CONSTITUENT MASS BALANCE RESULTS

F.6.1 FEMP

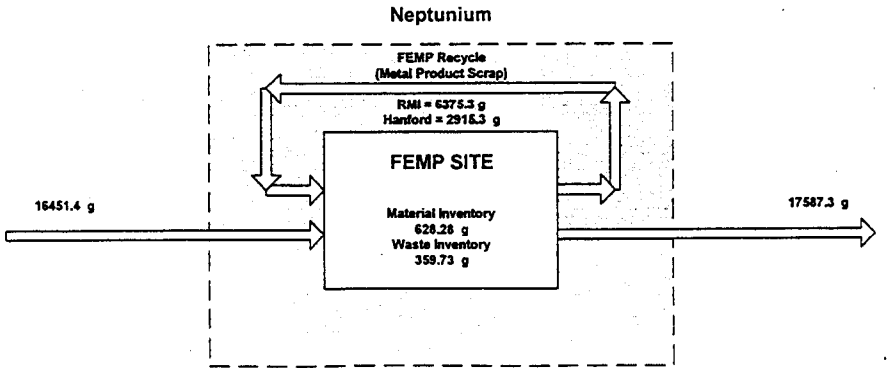
Tables F.5-1A and F.5-1B provide calculated constituent receipts and shipments data to and from the FEMP, respectively. In order to understand the constituent balance for the site more thoroughly, three figures have been presented below. The FEMP received recycled uranium directly from source sites, such as Hanford, and also received source site recycled uranium from other DOE sites, such as the A508 $UO_3$ shipped from the Paducah site. However, a significant quantity of FEMP recycled uranium receipts were actually returned shipments from the FEMP. Further processing of the FEMP product enriched metal by the RMI site resulted in processing scraps and residues being returned from RMI to the FEMP totaling 17,136.5 metric tons uranium. Similar return of scrap metal and processing residues from the

Hanford site accounts for 7,836.2 metric tons uranium. Since these streams are essentially recycling loops, the graphics below illustrate more realistic representations of actual recycle constituent masses that were received from sources. These values are more accurate for use in performing mass balances of recycle constituents across the DOE Complex.

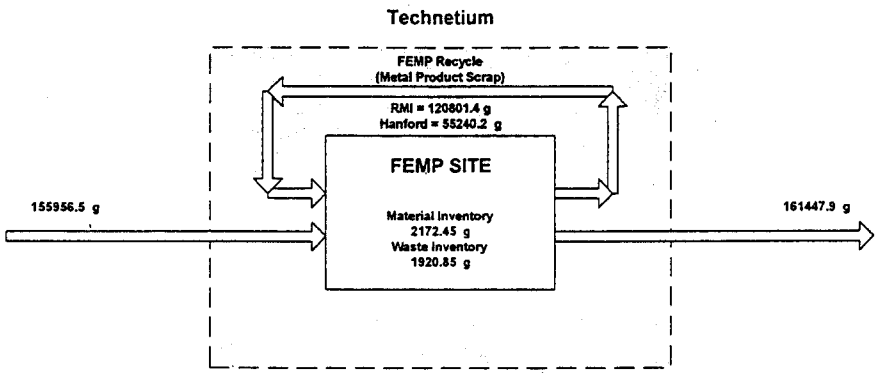
The plutonium mass balance for the FEMP illustrates a net 4.03 grams difference when shipments and inventory are removed from receipts. This value is less than 4 percent of source site receipts and well within the accuracy limitations of the data set and the process knowledge-based application of the data set.




The neptunium balance for the FEMP illustrates a net -2,123.9 grams difference when shipments and inventory are removed from receipts. This value is –12.9 percent of source site receipts, but also likely within the accuracy limitations of the data set and the process knowledge-based application of the data set.



The technetium balance for the FEMP illustrates a net –9,584.7 grams difference when shipments and inventory are removed from receipts. This value is –6.1 percent of source site receipts and well within the accuracy limitations of the data set and the process knowledge-based application of the data set.




F.6.2 RMI

The constituent mass balance for the RMI site reflects essentially no difference between receipt and shipment values for any of the three tracked constituents.

F.6.3 WVDP

Since the West Valley site was a source site, there is no receipts calculation. Shipments reflect only a small quantity of constituent, due to the limited mass of recycled uranium produced.

F.6.4 WSSRAP

The constituent mass balance for the Weldon Spring site reflects essentially no difference between receipt and shipment values for any of the three tracked constituents. Since the use of recycled uranium at the Weldon Spring site has not been definitely ascertained, the values may overstate site involvement with recycled uranium. Enriched uranium processing at the site is known to have been a very minor quantity of site production, representing less than 3 percent of total production.

## Table F.5-1A Calculated Constituent Masses for FEMP Receipts

| Isotopic Range | Shipping Site | Chemical Form(s) | Quantity of RU, MTU | Constituent Values | | | Calculated Constituent Mass | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ppb | | | Grams | | |
| | | | | Pu-239 | Np-237 | Tc-99 | Pu-239 | Np-237 | Tc-99 |
| Enriched | Hanford | Metal, UO2, U3O8, Residues | 7,836.2 | 4.297 | 372.03 | 7,049.36 | 33.7 | 2,915.3 | 55,240.2 |
| Enriched | Hanford - A508 | UO3 | 11,816.1 | 2.884 | 388.97 | 8,552.33 | 34.1 | 4,596.1 | 101,055.2 |
| Enriched | Idaho | Metal, Compounds | 1.6 | 0.502 | 54.90 | 201.61 | 0.0 | 0.1 | 0.3 |
| Enriched | Oak Ridge (K-25) | UF6 | 1,033.9 | 0.091 | 67.09 | 26.55 | 0.1 | 69.4 | 27.5 |
| Enriched | Oak Ridge (K-25) - Incinerator Ash | U3O8, UO2 | 26.2 | 47.616 | 3,164.53 | 263.32 | 1.2 | 82.9 | 6.9 |
| Enriched | Oak Ridge (K-25) - Tower Ash | Misc High Fluoride, UNH | 2.1 | 412.177 | 10,503.53 | 2,618.36 | 0.9 | 22.1 | 5.5 |
| Enriched | Oak Ridge (Y-12) | UO2, U3O8 | 88.1 | 2.884 | 388.97 | 8,552.23 | 0.3 | 34.3 | 753.5 |
| Enriched | Paducah - A508 | UO3 | 1,813.8 | 2.884 | 388.97 | 8,552.33 | 5.2 | 705.5 | 15,512.2 |
| Enriched | Paducah | UF6 | 5,464.6 | 0.091 | 67.09 | 26.55 | 0.5 | 366.6 | 145.1 |
| Enriched | Paducah - Incinerator Ash | U3O8 | 394.9 | 47.616 | 3,164.53 | 263.32 | 18.8 | 1,249.7 | 104.0 |
| Enriched | Paducah - Tower Ash | Misc High Fluoride | 23.4 | 412.177 | 10,503.53 | 2,618.36 | 9.6 | 245.8 | 61.3 |
| Enriched | Portsmouth | UF6 | 1,155.9 | 0.091 | 67.09 | 26.55 | 0.1 | 77.5 | 30.7 |
| Enriched | Portsmouth | U3O8, UNH | 16.9 | 412.177 | 10,503.53 | 2,618.36 | 7.0 | 177.5 | 44.3 |
| Enriched | RMI | Metal, U3O8, Residues | 17,136.5 | 4.297 | 372.03 | 7,049.36 | 73.6 | 6,375.3 | 120,801.4 |
| Enriched | Rocky Flats | Metal, Compounds | 1.3 | 0.502 | 54.90 | 201.61 | 0.0 | 0.1 | 0.3 |
| Enriched | Savannah River | Metal | 2,822.5 | 4.297 | 372.03 | 7,049.36 | 12.1 | 1,050.1 | 19,896.8 |
| Enriched | Savannah River | UO3 | 574.1 | 2.884 | 388.97 | 8,552.33 | 1.7 | 223.3 | 4,909.9 |
| Enriched | Savannah River | UNH | 27.2 | 16.527 | | | 0.4 | 0.0 | 0.0 |
| Enriched | Weldon Spring | Metal, UO3, Residues | 810.9 | 2.884 | 388.97 | 8,552.33 | 2.3 | 315.4 | 6,935.1 |
| Enriched | West Valley | UNH | 463.2 | 3.947 | 139.00 | 3,155.10 | 1.8 | 64.4 | 1,461.4 |
| Enriched | Other Sites/Federal Agencies | Metal, U3O8, UO2 | 8,671.3 | 0.502 | 54.90 | 201.61 | 4.4 | 476.1 | 1,748.2 |
| **Total Enriched** | | | **60,180.7** | | | | **207.8** | **19,047.3** | **328,739.6** |
| Normal | Hanford | Metal, Residues | 2,635.1 | 0.091 | 67.09 | 26.55 | 0.2 | 176.8 | 70.0 |
| Normal | Idaho | Metal, Residues | 0.0 | 0.091 | 67.09 | 26.55 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (K-25) | UF6 | 246.1 | 0.091 | 67.09 | 26.55 | 0.0 | 16.5 | 6.5 |
| Normal | Oak Ridge (Y-12) | Metal | 18.4 | 0.091 | 67.09 | 26.55 | 0.0 | 1.2 | 0.5 |
| Normal | Paducah | UO3, UF4 | 130.0 | 0.091 | 67.09 | 26.55 | 0.0 | 8.7 | 3.5 |
| Normal | Portsmouth | UF6 | 541.4 | 0.091 | 67.09 | 26.55 | 0.0 | 36.3 | 14.4 |
| Normal | RMI | Metal, U3O8 | 4,997.7 | 0.091 | 67.09 | 26.55 | 0.5 | 335.3 | 132.7 |
| Normal | Rocky Flats | Metal | 4.0 | 0.091 | 67.09 | 26.55 | 0.0 | 0.3 | 0.1 |
| Normal | Savannah River | Metal | 1,298.7 | 0.091 | 67.09 | 26.55 | 0.1 | 87.1 | 34.5 |
| Normal | Weldon Spring | Metal, Ore Conc., Residues | 44,547.4 | 0.00 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | West Valley | UNH | 12.9 | 0.091 | 67.09 | 26.55 | 0.0 | 0.9 | 0.3 |
| Normal | Other Sites/Federal Agencies | Various | 35,217.4 | 0.091 | 67.09 | 26.55 | 3.2 | 2,362.7 | 935.0 |
| **Total Normal** | | | **89,649.1** | | | | **4.1** | **3,025.9** | **1,197.4** |
| Depleted | Hanford | Metal | 481.7 | 0.007 | 2.54 | 9.12 | 0.0 | 1.2 | 4.4 |
| Depleted | Idaho | Metal | 0.3 | 0.007 | 2.54 | 9.12 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (K-25) | UF6 | 1,413.3 | 0.502 | 54.90 | 201.61 | 0.7 | 77.6 | 284.9 |
| Depleted | Oak Ridge (Y-12) | Metal | 21.4 | 0.007 | 2.54 | 9.12 | 0.0 | 0.1 | 0.2 |
| Depleted | Paducah | UF4, UF6 | 51,872.8 | 0.091 | 67.09 | 26.55 | 4.7 | 3,480.1 | 1,377.2 |
| Depleted | Portsmouth | UF6 | 0.1 | 0.502 | 54.90 | 201.61 | 0.0 | 0.0 | 0.0 |
| Depleted | RMI | Metal, U3O8 | 35,678.7 | 0.007 | 2.54 | 9.12 | 0.2 | 90.6 | 325.4 |
| Depleted | Rocky Flats | Metal | 1,318.2 | 0.007 | 2.54 | 9.12 | 0.0 | 3.3 | 12.0 |
| Depleted | Savannah River | Metal | 1,669.6 | 0.007 | 2.54 | 9.12 | 0.0 | 4.2 | 15.2 |
| Depleted | Weldon Spring | Metal, UF4, UO3 | 5.1 | 0.502 | 54.90 | 201.61 | 0.0 | 0.3 | 1.0 |
| Depleted | West Valley | UNH | 142.1 | 0.007 | 2.54 | 9.12 | 0.0 | 0.4 | 1.3 |
| Depleted | Other Sites/Federal Agencies | Metal, Compounds | 4,249.9 | 0.007 | 2.54 | 9.12 | 0.0 | 10.8 | 38.8 |
| **Total Depleted** | | | **96,853.2** | | | | **5.7** | **3,668.7** | **2,060.5** |

## Table F.5-1B Calculated Constituent Masses for FEMP Shipments

| Isotopic Range | Receiving Site | Chemical Form(s) | Quantity of RU, MTU | Constituent Values | | | Calculated Constituent Mass | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ppb | | | Grams | | |
| | | | | Pu-239 | Np-237 | Tc-99 | Pu-239 | Np-237 | Tc-99 |
| Enriched | Hanford | Metal | 17,467.5 | 1.165 | 263.48 | 447.81 | 20.3 | 4,602.3 | 7,822.1 |
| Enriched | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (K-25) | UNH | 4.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (Y-12) | Metal, Compounds | 31.7 | 2.884 | 388.97 | 8,552.23 | 0.1 | 12.3 | 271.1 |
| Enriched | Paducah | UO3, UF4 | 7,206.7 | 2.884 | 388.97 | 8,552.23 | 20.8 | 2,803.2 | 61,633.4 |
| Enriched | Paducah | UF6 | 13.1 | 1.259 | 81.39 | 2,109.61 | 0.0 | 1.1 | 27.6 |
| Enriched | Portsmouth | UF6, Compounds | 129.0 | 1.259 | 81.39 | 2,109.61 | 0.2 | 10.5 | 272.1 |
| Enriched | Portsmouth | U3O8 | 16.9 | 16.530 | | | 0.3 | 0.0 | 0.0 |
| Enriched | RMI | Metal | 26,210.6 | 4.297 | 372.03 | 7,049.36 | 112.6 | 9,751.1 | 184,768.0 |
| Enriched | Rocky Flats | Metal, Compounds | 2.1 | 2.884 | 388.97 | 8,552.23 | 0.0 | 0.8 | 18.0 |
| Enriched | Savannah River | Metal | 3,971.2 | 2.884 | 388.97 | 8,552.23 | 11.5 | 1,544.7 | 33,962.6 |
| Enriched | Weldon Spring | Metal, UO3, Residues | 837.5 | 2.884 | 388.97 | 8,552.23 | 2.4 | 325.8 | 7,162.5 |
| Enriched | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Other Sites/Federal Agencies | Metal, Compounds | 4,415.4 | 2.884 | 388.97 | 8,552.23 | 12.7 | 1,717.5 | 37,761.5 |
| **Total Enriched** | | | **60,305.7** | | | | **180.9** | **20,769.3** | **333,698.9** |
| Normal | Hanford | Metal | 30,788.3 | 0.091 | 67.09 | 26.55 | 2.8 | 2,065.6 | 817.4 |
| Normal | Idaho | Metal, Compounds | 0.5 | 0.091 | 67.09 | 26.55 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (K-25) | UF6 | 13.4 | 0.091 | 67.09 | 26.55 | 0.0 | 0.9 | 0.4 |
| Normal | Oak Ridge (Y-12) | Metal, Compounds | 108.0 | 0.091 | 67.09 | 26.55 | 0.0 | 7.2 | 2.9 |
| Normal | Paducah | UO3, UF4 | 25,914.2 | 0.091 | 67.09 | 26.55 | 2.4 | 1,738.6 | 688.0 |
| Normal | Portsmouth | UF6, UO3, Metal, UF4 | 701.3 | 0.091 | 67.09 | 26.55 | 0.1 | 47.1 | 18.6 |
| Normal | RMI | Metal | 5,235.6 | 0.091 | 67.09 | 26.55 | 0.5 | 351.3 | 139.0 |
| Normal | Rocky Flats | Metal | 0.0 | 0.091 | 67.09 | 26.55 | 0.0 | 0.0 | 0.0 |
| Normal | Savannah River | Metal | 3,982.8 | 0.091 | 67.09 | 26.55 | 0.4 | 267.2 | 105.7 |
| Normal | Weldon Spring | Metal, UO3, Residues | 10,133.3 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | West Valley | Metal | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Other Sites/Federal Agencies | Metal, Compounds | 17,975.4 | 0.091 | 67.09 | 26.55 | 1.6 | 1,206.0 | 477.2 |
| **Total Normal** | | | **94,852.8** | | | | **7.7** | **5,683.8** | **2,249.3** |
| Depleted | Hanford | Metal | 125.6 | 0.007 | 2.54 | 9.12 | 0.0 | 0.3 | 1.1 |
| Depleted | Idaho | Metal | 83.9 | 0.007 | 2.54 | 9.12 | 0.0 | 0.2 | 0.8 |
| Depleted | Oak Ridge (K-25) | UF6, Compounds | 0.2 | 0.502 | 54.90 | 201.61 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (Y-12) | Metal | 9,390.4 | 0.007 | 2.54 | 9.12 | 0.1 | 23.9 | 85.6 |
| Depleted | Paducah | UF6, UO3, UF4 | 3,554.8 | 0.502 | 54.90 | 201.61 | 1.8 | 195.2 | 716.7 |
| Depleted | Portsmouth | UF4 | 1.1 | 0.502 | 54.90 | 201.61 | 0.0 | 0.1 | 0.2 |
| Depleted | RMI | Metal | 35,875.3 | 0.007 | 2.54 | 9.12 | 0.3 | 91.1 | 327.2 |
| Depleted | Rocky Flats | Metal | 5,352.5 | 0.007 | 2.54 | 9.12 | 0.0 | 13.6 | 48.8 |
| Depleted | Savannah River | Metal | 24,193.6 | 0.007 | 2.54 | 9.12 | 0.2 | 61.5 | 220.6 |
| Depleted | Weldon Spring | Metal, Compounds | 2.8 | 0.007 | 2.54 | 9.12 | 0.0 | 0.0 | 0.0 |
| Depleted | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Other Sites/Federal Agencies | Metal, Compounds | 15,490.9 | 0.007 | 2.54 | 9.12 | 0.1 | 39.3 | 141.3 |
| **Total Depleted** | | | **94,071.1** | | | | **2.4** | **424.8** | **1,541.3** |
| **TOTAL SHIPMENTS** | | | **249,229.6** | | | | **191.1** | **26,877.9** | **337,489.5** |

## Table F.5-1C Calculated Constituent Masses for FEMP Nuclear Materials Inventory

| Isotopic Range | Material | Chemical Form(s) | Quantity of RU, MTU | Constituent Values ppb | | | Calculated Constituent Mass Grams | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Pu-239 | Np-237 | Tc-99 | Pu-239 | Np-237 | Tc-99 |
| **Nuclear Materials** | | | | | | | | | |
| Enriched | 1.25% Derbies | Metal | 93.9 | 9.305 | 311.97 | 1721 | 0.874 | 29.294 | 161.602 |
| Enriched | 0.95% Ingots | Metal | 1.2 | 9.305 | 311.97 | 1721 | 0.011 | 0.374 | 2.065 |
| Enriched | 1.25% Ingots | Metal | 2.3 | 9.305 | 311.97 | 1721 | 0.021 | 0.718 | 3.958 |
| Enriched | <1.00% Recycle | Metal | 107.1 | 9.305 | 311.97 | 1721 | 0.997 | 33.412 | 184.319 |
| Enriched | >1.00% Recycle | Metal | 87.5 | 9.305 | 311.97 | 1721 | 0.814 | 27.297 | 150.588 |
| Enriched | U3O8 | U3O8 | 0.6 | 23.969 | 1045.29 | 2789.56 | 0.014 | 0.627 | 1.674 |
| Enriched | UO2 | UO2 | 0.8 | 23.969 | 1045.29 | 2789.56 | 0.019 | 0.836 | 2.232 |
| Enriched | 0.82 - 1.00% UO3 | UO3 | 6.5 | 20.772 | 498.17 | 2405.28 | 0.135 | 3.238 | 15.634 |
| Enriched | >1.00 - 1.25% UO3 | UO3 | 162.3 | 20.772 | 498.17 | 2405.28 | 3.371 | 80.853 | 390.377 |
| Enriched | 0.72 - 1.00% UF4 | UF4 | 6.8 | 23.969 | 1045.29 | 2789.56 | 0.163 | 7.108 | 18.969 |
| Enriched | >1.00 - 2.00% UF4 | UF4 | 38.3 | 23.969 | 1045.29 | 2789.56 | 0.918 | 40.035 | 106.840 |
| Enriched | <1.00% Recoverable Residues | Metal & Oxides | 220.4 | 23.969 | 1045.29 | 2789.56 | 5.283 | 230.382 | 614.819 |
| Enriched | >1.00% Recoverable Residues | Metals & Oxides | 73.6 | 23.969 | 1045.29 | 2789.56 | 1.764 | 76.933 | 205.312 |
| **Total Enriched** | | | 801.3 | | | | 14.385 | 531.108 | 1858.388 |
| Depleted | MK31 Derbies | Metal | 0.6 | 0.007 | 2.54 | 9.12 | 0.000 | 0.002 | 0.005 |
| Depleted | MK31 Ingots | Metal | 335.6 | 0.007 | 2.54 | 9.12 | 0.002 | 0.852 | 3.061 |
| Depleted | Cores | Metal | 603.0 | 0.007 | 2.54 | 9.12 | 0.004 | 1.532 | 5.499 |
| Depleted | Recycle | Metal | 396.0 | 0.007 | 2.54 | 9.12 | 0.003 | 1.006 | 3.612 |
| Depleted | UF4 | UF4 | 1471.9 | 0.502 | 54.9 | 201.61 | 0.739 | 80.807 | 296.750 |
| **Total Depleted** | | | 2807.1 | | | | 0.748 | 84.199 | 308.927 |
| Normal | Derbies | Metal | 3.6 | 0.091 | 67.09 | 26.55 | 0.000 | 0.242 | 0.096 |
| Normal | Ingots/Cores | Metal | 32.5 | 0.091 | 67.09 | 26.55 | 0.003 | 2.180 | 0.863 |
| Normal | Recycle | Metal | 152.7 | 0.091 | 67.09 | 26.55 | 0.014 | 10.245 | 4.054 |
| Normal | UO3 | UO3 | 0.0 | 0.091 | 67.09 | 26.55 | 0.000 | 0.000 | 0.000 |
| Normal | UF4 | UF4 | 4.6 | 0.091 | 67.09 | 26.55 | 0.000 | 0.309 | 0.122 |
| **Total Normal** | | | 193.4 | | | | 0.018 | 12.975 | 5.135 |
| **Total Nuclear Material Inventory** | | | 3801.8 | | | | 15.151 | 628.282 | 2172.450 |

## Table F.5-1D Calculated Constituent Masses for FEMP Waste Inventory

| Isotopic Range | Waste Material | Chemical Form(s) | Quantity of RU (MTU) | Constituent Values ppb | | | Calculated Constituent Mass Grams | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Pu-239 | Np-237 | Tc-99 | Pu-239 | Np-237 | Tc-99 |
| Enriched | Misc. TSCA/Mixed Wastes | Metal/Compounds | 16.8 | 4.297 | 372.03 | 7049.36 | 0.072 | 6.250 | 118.429 |
| Enriched | Contaminated Trash/Debris | Varies | 0.4 | 4.297 | 372.03 | 7049.36 | 0.002 | 0.162 | 3.066 |
| Enriched | Contaminated Copper | Metal | 0.0 | 0.502 | 54.9 | 201.61 | 0.000 | 0.000 | 0.001 |
| Enriched | Contaminated Soils/Samples | Varies | 1.9 | 4.297 | 372.03 | 7049.36 | 0.008 | 0.722 | 13.690 |
| Enriched | Containerized Pit Wastes | Compounds | 0.0 | 27.43 | 864.1 | 4172 | 0.001 | 0.022 | 0.106 |
| Enriched | Misc. Liquids | Metals and Compounds | 0.0 | 4.297 | 372.03 | 7049.36 | 0.000 | 0.001 | 0.026 |
| Enriched | U Metal Wastes | Metal | 138.1 | 4.297 | 372.03 | 7049.36 | 0.594 | 51.386 | 973.690 |
| Enriched | UO3 | UO3 | 5.5 | 23.969 | 1045.29 | 2789.56 | 0.131 | 5.709 | 15.236 |
| Enriched | U3O8 | U3O8 | 263.1 | 23.969 | 1045.29 | 2789.56 | 6.307 | 275.056 | 734.039 |
| Enriched | UF4 | UF4 | 0.3 | 23.969 | 1045.29 | 2789.56 | 0.007 | 0.314 | 0.837 |
| Enriched | UO2 | UO2 | 3.3 | 23.969 | 1045.29 | 2789.56 | 0.080 | 3.486 | 9.304 |
| Enriched | MgF2 | MgF2 | 1.1 | 96.618 | 1881.53 | 1651.23 | 0.102 | 1.989 | 1.746 |
| **Total Enriched** | | | 430.6 | | | | **7.304** | **345.098** | **1870.170** |
| Normal | Misc. TSCA/Mixed Wastes | Metal/Compounds | 0.1 | 0.091 | 67.09 | 26.55 | 0.000 | 0.004 | 0.002 |
| Normal | Contaminated Trash/Debris | Varies | 0.2 | 0.091 | 67.09 | 26.55 | 0.000 | 0.013 | 0.005 |
| Normal | Contaminated Copper | Metal | 0.0 | 0.502 | 54.9 | 201.61 | 0.000 | 0.000 | 0.000 |
| Normal | Contaminated Soils/Samples | Varies | 0.1 | 0.091 | 67.09 | 26.55 | 0.000 | 0.008 | 0.003 |
| Normal | Containerized Pit Wastes | Compounds | 0.0 | 0.091 | 67.09 | 26.55 | 0.000 | 0.002 | 0.001 |
| Normal | Misc. Liquids | Metals and Compounds | 0.0 | 0.091 | 67.09 | 26.55 | 0.000 | 0.000 | 0.000 |
| Normal | U Metal Wastes | Metal | 3.6 | 0.091 | 67.09 | 26.55 | 0.000 | 0.239 | 0.095 |
| Normal | UO3 | UO3 | 3.3 | 0.091 | 67.09 | 26.55 | 0.000 | 0.219 | 0.087 |
| Normal | UO2 | UO2 | 1.4 | 0.091 | 67.09 | 26.55 | 0.000 | 0.091 | 0.036 |
| Normal | U3O8 | U3O8 | 4.5 | 0.091 | 67.09 | 26.55 | 0.000 | 0.300 | 0.11 |
| Normal | UF4 | UF4 | 0.2 | 0.091 | 67.09 | 26.55 | 0.000 | 0.011 | 0.0 |
| Normal | MgF2 | MgF2 | 0.0 | 0.091 | 67.09 | 26.55 | 0.000 | 0.000 | 0.0 |
| **Total Normal** | | | 13.2 | | | | **0.001** | **0.886** | **0.351** |
| Depleted | Misc. TSCA/Mixed Wastes | Metal/Compounds | 24.5 | 0.007 | 2.54 | 9.12 | 0.000 | 0.062 | 0.224 |
| Depleted | Contaminated Trash/Debris | Varies | 0.2 | 0.007 | 2.54 | 9.12 | 0.000 | 0.000 | 0.002 |
| Depleted | Contaminated Copper | Metal | 0.0 | 0.502 | 54.9 | 201.61 | 0.000 | 0.000 | 0.001 |
| Depleted | Contaminated Soils/Samples | Varies | 0.9 | 0.007 | 2.54 | 9.12 | 0.000 | 0.002 | 0.008 |
| Depleted | Containerized Pit Wastes | Compounds | 0.1 | 0.502 | 54.9 | 201.61 | 0.000 | 0.006 | 0.024 |
| Depleted | Misc. Liquids | Metals and Compounds | 0.0 | 0.007 | 2.54 | 9.12 | 0.000 | 0.000 | 0.000 |
| Depleted | U Metal Wastes | Metal | 621.0 | 0.007 | 2.54 | 9.12 | 0.004 | 1.577 | 5.664 |
| Depleted | UO3 | UO3 | 137.7 | 0.502 | 54.9 | 201.61 | 0.069 | 7.560 | 27.762 |
| Depleted | U3O8 | U3O8 | 18.8 | 0.502 | 54.9 | 201.61 | 0.009 | 1.032 | 3.790 |
| Depleted | UF4 | UF4 | 62.0 | 0.502 | 54.9 | 201.61 | 0.031 | 3.404 | 12.500 |
| Depleted | MgF2 | MgF2 | 1.8 | 0.502 | 54.9 | 201.61 | 0.001 | 0.096 | 0.353 |
| **Total Depleted** | | | 867.0 | | | | **0.115** | **13.741** | **50.326** |
| **Total Waste Inventory** | | | 1310.8 | | | | **7.420** | **359.725** | **1920.847** |

## Table F.5-2A Calculated Constituent Masses for RMI Receipts

| Isotopic Range | Shipping Site | Chemical Form(s) | Quantity of RU, MTU | Constituent Values | | | Calculated Constituent Mass | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ppb | | | Grams | | |
| | | | | Pu-239 | Np-237 | Tc-99 | Pu-239 | Np-237 | Tc-99 |
| Enriched | Fernald | Metal | 25,214.9 | 4.297 | 372.03 | 7,049.36 | 108.3 | 9,380.7 | 177,748.9 |
| Enriched | Hanford | Metal | 112.5 | 4.297 | 372.03 | 7,049.36 | 0.5 | 41.9 | 793.1 |
| Enriched | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Other Sites/Federal Agencies | Metal | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Total Enriched** | | | 25,327.4 | | | | **108.8** | **9,422.6** | **178,542.0** |
| Normal | Fernald | Metal | 5,235.6 | 0.091 | 67.09 | 26.55 | 0.5 | 351.3 | 139.0 |
| Normal | Hanford | Metal | 0.4 | 0.091 | 67.09 | 26.55 | 0.0 | 0.0 | 0.0 |
| Normal | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Other Sites/Federal Agencies | Metal | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Total Normal** | | | 5,236.0 | | | | **0.5** | **351.3** | **139.0** |
| Depleted | Fernald | Metal | 35,878.7 | 0.007 | 2.54 | 9.12 | 0.3 | 91.1 | 327.2 |
| Depleted | Hanford | Metal | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (Y-12) | | 240.3 | 0.007 | 2.54 | 9.12 | 0.0 | 0.6 | 2.2 |
| Depleted | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Rocky Flats | | 9.0 | 0.007 | 2.54 | 9.12 | 0.0 | 0.0 | 0.1 |
| Depleted | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Other Sites/Federal Agencies | Metal | 10,030.5 | 0.007 | 2.54 | 9.12 | 0.1 | 25.5 | 91.5 |
| **Total Depleted** | | | 46,158.5 | | | | **0.3** | **117.2** | **421.0** |
| **TOTAL RECEIPTS** | | | 76,721.9 | | | | **109.6** | **9,891.1** | **179,101.9** |

## Table F.5-2B Calculated Constituent Masses for RMI Shipments

| Isotopic Range | Receiving Site | Chemical Form(s) | Quantity of RU, MTU | Constituent Values ppb | | | Calculated Constituent Mass Grams | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Pu-239 | Np-237 | Tc-99 | Pu-239 | Np-237 | Tc-99 |
| Enriched | Fernald | Metal, U3O8, Waste | 15,973.3 | 4.297 | 372.03 | 7,049.36 | 68.6 | 5,942.5 | 112,601.5 |
| Enriched | Hanford | Metal | 9,296.3 | 4.297 | 372.03 | 7,049.36 | 39.9 | 3,458.5 | 65,533.0 |
| Enriched | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Other Sites/Federal Agencies | Metal, Wastes | 0.2 | 4.297 | 372.03 | 7,049.36 | 0.0 | 0.1 | 1.4 |
| **Total Enriched** | | | **25,269.8** | | | | **108.6** | **9,401.1** | **178,135.9** |
| Normal | Fernald | Metal, U3O8, Waste | 4,970.2 | 0.091 | 67.09 | 26.55 | 0.5 | 333.5 | 132.0 |
| Normal | Hanford | Metal | 209.4 | 0.091 | 67.09 | 26.55 | 0.0 | 14.0 | 5.6 |
| Normal | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Weldon Spring | Metal | 2.2 | 0.091 | 67.09 | 26.55 | 0.0 | 0.1 | 0.1 |
| Normal | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Other Sites/Federal Agencies | Metal, Wastes | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Total Normal** | | | **5,181.8** | | | | **0.5** | **347.6** | **137.6** |
| Depleted | Fernald | Metal, U3O8, Wastes | 35,855.7 | 0.007 | 2.54 | 9.12 | 0.3 | 91.1 | 327.0 |
| Depleted | Hanford | Metal | 12.4 | 0.007 | 2.54 | 9.12 | 0.0 | 0.0 | 0.1 |
| Depleted | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (Y-12) | Metal | 224.2 | 0.007 | 2.54 | 9.12 | 0.0 | 0.6 | 2.0 |
| Depleted | Paducah | Metal | 3.0 | 0.007 | 2.54 | 9.12 | 0.0 | 0.0 | 0.0 |
| Depleted | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Rocky Flats | Metal | 8.8 | 0.007 | 2.54 | 9.12 | 0.0 | 0.0 | 0.1 |
| Depleted | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Other Sites/Federal Agencies | Metal, Wastes | 9,618.5 | 0.007 | 2.54 | 9.12 | 0.1 | 24.4 | 87.7 |
| **Total Depleted** | | | **45,722.7** | | | | **0.1** | **25.0** | **89.9** |
| **TOTAL SHIPMENTS** | | | **76,174.3** | | | | **109.1** | **9,773.8** | **178,363.4** |

## Table F.5-3 Calculated Constituent Masses for West Valley Shipments

| Isotopic Range | Receiving Site | Chemical Form(s) | Quantity of RU, MTU | Constituent Values | | | Calculated Constituent Mass | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ppb | | | Grams | | |
| | | | | Pu-239 | Np-237 | Tc-99 | Pu-239 | Np-237 | Tc-99 |
| Enriched | Fernald | UNH, Residues | 463.2 | 3.947 | 139.00 | 3,155.10 | 1.8 | 64.4 | 1,461.4 |
| Enriched | Hanford | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (Y-12) | UNH, Residues | 1.2 | 3.947 | 139.00 | 3,155.10 | 0.0 | 0.2 | 3.8 |
| Enriched | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Other Sites/Federal Agencies | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Total Enriched** | | | **464.4** | | | | **1.8** | **64.6** | **1,465.2** |
| Normal | Fernald | UNH, Residues | 12.9 | 3.947 | 139.00 | 3,155.10 | 0.1 | 1.8 | 40.7 |
| Normal | Hanford | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Other Sites/Federal Agencies | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Total Normal** | | | **12.9** | | | | **0.1** | **1.8** | **40.7** |
| Depleted | Fernald | UNH, Residues | 142.1 | 3.947 | 139.00 | 3,155.10 | 0.6 | 19.8 | 448.3 |
| Depleted | Hanford | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Other Sites/Federal Agencies | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Total Depleted** | | | **142.1** | | | | **0.6** | **19.8** | **448.3** |
| **TOTAL SHIPMENTS** | | | **619.4** | | | | **2.4** | **86.1** | **1,954.3** |

## Table F.5-4A Calculated Constituent Masses for Weldon Spring Receipts

| Isotopic Range | Shipping Site | Chemical Form(s) | Quantity of RU, MTU | Constituent Values | | | Calculated Constituent Mass | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | ppb | | | Grams | | |
| | | | | Pu-239 | Np-237 | Tc-99 | Pu-239 | Np-237 | Tc-99 |
| Enriched | Fernald | Metal, UO3, UF4 | 837.5 | 2.884 | 388.97 | 8,552.23 | 2.4 | 325.8 | 7,162.5 |
| Enriched | Hanford | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Other Sites/Federal Agencies | UF4, UO3, UF6 | 5.1 | 2.884 | 388.97 | 8,552.23 | 0.0 | 2.0 | 43.6 |
| **Total Enriched** | | | **842.6** | | | | **2.4** | **327.7** | **7,206.1** |
| Normal | Fernald | Metal, UO3, UF4, UF6 | 10,133.3 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Hanford | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Other Sites/Federal Agencies | UF4, UO3, UF6 | 60,405.1 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Total Normal** | | | **70,538.4** | | | | **0.0** | **0.0** | **0.0** |
| Depleted | Fernald | UO3, UF4, UF6 | 2.8 | 0.007 | 2.54 | 9.12 | 0.0 | 0.0 | 0.0 |
| Depleted | Hanford | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Other Sites/Federal Agencies | UF4, UO3, UF6 | 29.2 | 0.007 | 2.54 | 9.12 | 0.0 | 0.1 | 0.3 |
| **Total Depleted** | | | **32.0** | | | | **0.0** | **0.1** | **0.3** |
| **TOTAL RECEIPTS** | | | **71,413.0** | | | | **2.4** | **327.8** | **7,206.4** |

## Table F.5-4B Calculated Constituent Masses for Weldon Spring Shipments

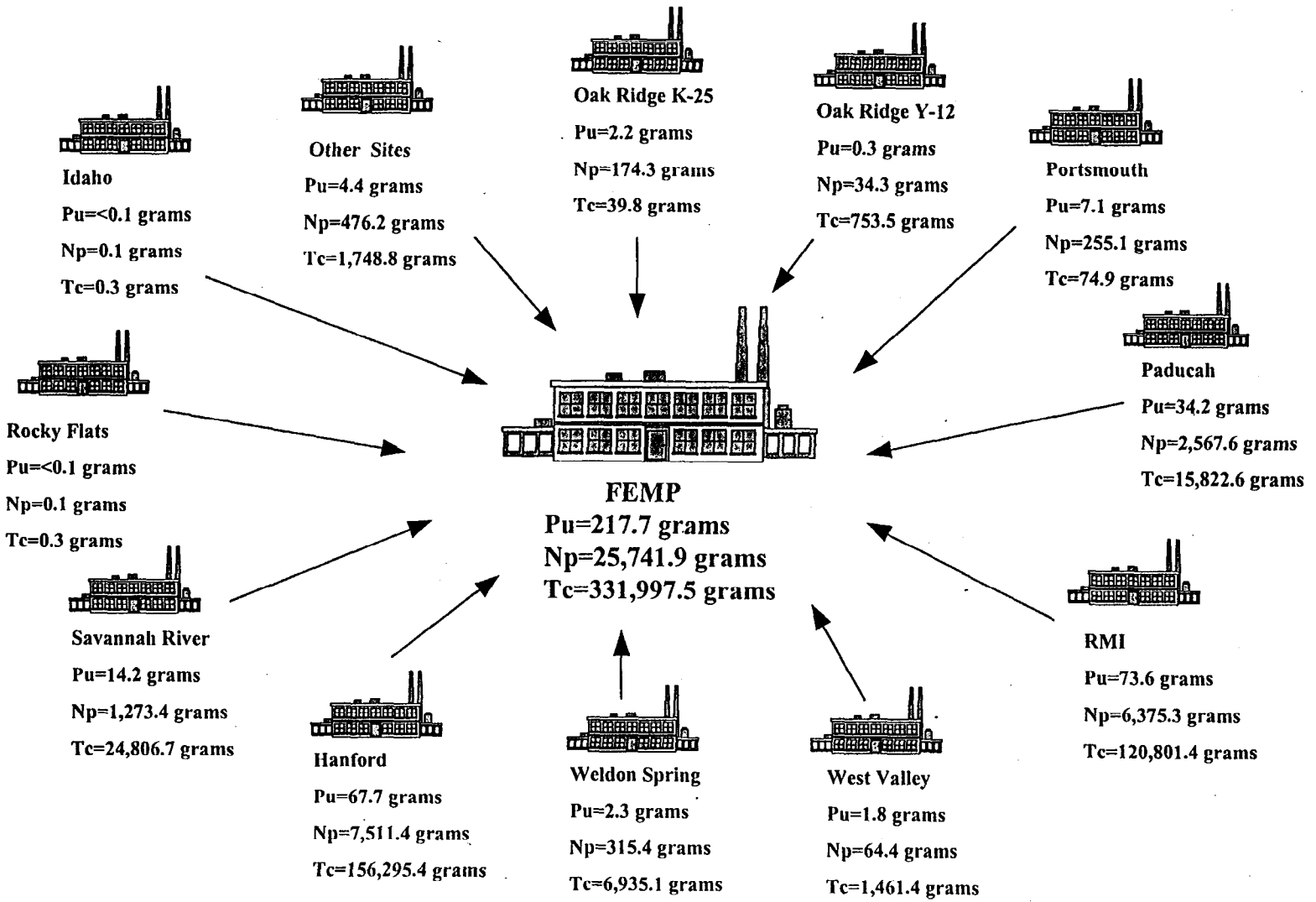
| Isotopic Range | Receiving Site | Chemical Form(s) | Quantity of RU, MTU | Constituent Values ppb | | | Calculated Constituent Mass Grams | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Pu-239 | Np-237 | Tc-99 | Pu-239 | Np-237 | Tc-99 |
| Enriched | Fernald | Metal | 810.8 | 2.884 | 388.97 | 8,552.23 | 2.3 | 315.4 | 6,934.1 |
| Enriched | Hanford | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Enriched | Other Sites/Federal Agencies | Metal, Wastes | 23.1 | 2.884 | 388.97 | 8,552.23 | 0.1 | 9.0 | 197.6 |
| **Total Enriched** | | | **833.9** | | | | **2.4** | **324.4** | **7,131.7** |
| Normal | Fernald | Metal, UO3, UF4 | 44,547.8 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Hanford | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Normal | Other Sites/Federal Agencies | Metal, UO3, UF4 | 29,331.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Total Normal** | | | **73,878.8** | | | | **0.0** | **0.0** | **0.0** |
| Depleted | Fernald | UF4, UF6 | 5.1 | 0.007 | 2.54 | 9.12 | 0.0 | 0.0 | 0.0 |
| Depleted | Hanford | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Idaho | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (K-25) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Oak Ridge (Y-12) | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Paducah | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Portsmouth | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Rocky Flats | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Savannah River | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Weldon Spring | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | West Valley | | 0.0 | 0.000 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| Depleted | Other Sites/Federal Agencies | UF4, UF6 | 87.2 | 0.007 | 2.54 | 9.12 | 0.0 | 0.2 | 0.8 |
| **Total Depleted** | | | **92.4** | | | | **0.0** | **0.2** | **0.8** |
| **TOTAL SHIPMENTS** | | | **74,805.1** | | | | **2.4** | **324.6** | **7,132.5** |

## Table F.5-5 Calculated Constituent Masses for Environmental Releases

| Site | Environmental Release | Chemical Form(s) | Quantity of RU, MTU | Constituent Values ppb | | | Calculated Constituent Mass Grams | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Pu-239 | Np-237 | Tc-99 | Pu-239 | Np-237 | Tc-99 |
| FEMP (Routine) | Dust Collectors | Metal, Compounds | 19.4 | 2.884 | 388.97 | 8,552.33 | 0.1 | 7.5 | 165.9 |
| FEMP (Routine) | Wet Scrubbers | Various | 21.6 | 2.884 | 388.97 | 8,552.33 | 0.1 | 8.4 | 184.7 |
| FEMP (Routine) | Gulping Operations | UNH | 25.7 | 2.884 | 388.97 | 8,552.33 | 0.1 | 10.0 | 219.8 |
| FEMP (Routine) | Other | UF6 | 6.4 | 2.884 | 388.97 | 8,552.33 | 0.0 | 2.5 | 54.7 |
| FEMP (Non-Routine) | Pilot Plant UF6 | UF6 | 1.5 | 0.502 | 54.90 | 201.61 | 0.0 | 0.1 | 0.3 |
| FEMP (Non-Routine) | Plant 2/3 | UO3,U3O8, UO2 | 22.6 | 23.969 | 1,045.29 | 2,789.56 | 0.5 | 23.6 | 63.0 |
| FEMP (Non-Routine) | Other Non-Routine Production | Metal, Compounds | 2.1 | 2.884 | 388.97 | 8,552.33 | 0.0 | 0.8 | 18.0 |
| FEMP (Non-Production) | FEMP Incinerators | U3O8, UO2 | 3.1 | 23.969 | 1,045.29 | 2,789.56 | 0.1 | 3.2 | 8.6 |
| FEMP (Non-Production) | FEMP Storage | Metal, Compounds | 1.0 | 84.817 | 3,999.32 | 4,110.05 | 0.1 | 4.0 | 4.1 |
| FEMP (Non-Production) | Other Airborne Emissions | UO2, U3O8 | 0.3 | 16.035 | 1,328.11 | 2,399.22 | 0.0 | 0.4 | 0.7 |
| FEMP (Liquid) | Liquid Effluents | Metal, Compounds | 66.5 | 16.035 | 1,328.11 | 2,399.22 | 1.1 | 88.3 | 159.5 |
| **Total FEMP Releases** | | | 170.2 | | | | 2.0 | 148.9 | 879.5 |
| RMI | Airborne Releases | Metal, U3O8 | 0.0 | 2.884 | 388.97 | 8,552.33 | 0.0 | 0.0 | 0.0 |
| RMI | Liquid Effluents | Metal, U3O8 | 0.0 | 16.035 | 1,328.11 | 2,399.22 | 0.0 | 0.0 | 0.0 |
| **Total RMI Releases** | | | 0.0 | | | | 0.0 | 0.0 | 0.0 |
| West Valley | Airborne Releases | UNH | 0.0 | 3.947 | 139.00 | 3,155.10 | 0.0 | 0.0 | 0.0 |
| West Valley | Liquid Effluents | UNH | 0.0 | 3.947 | 139.00 | 3,155.10 | 0.0 | 0.0 | 0.0 |
| **Total WV Releases** | | | 0.0 | | | | 0.0 | 0.0 | 0.0 |
| Weldon Spring | Airborne Releases | Metal, Compounds, UF6 | 45.0 | 0.091 | 67.09 | 26.55 | 0.0 | 3.0 | 1.2 |
| Weldon Spring | Liquid Effluents | Metal, Compounds | 183.0 | 0.091 | 67.09 | 26.55 | 0.0 | 12.3 | 4.9 |
| **Total WSSRAP Releases** | | | 228.0 | | | | 0.0 | 15.3 | 6.1 |

## FIGURE F.5-1A

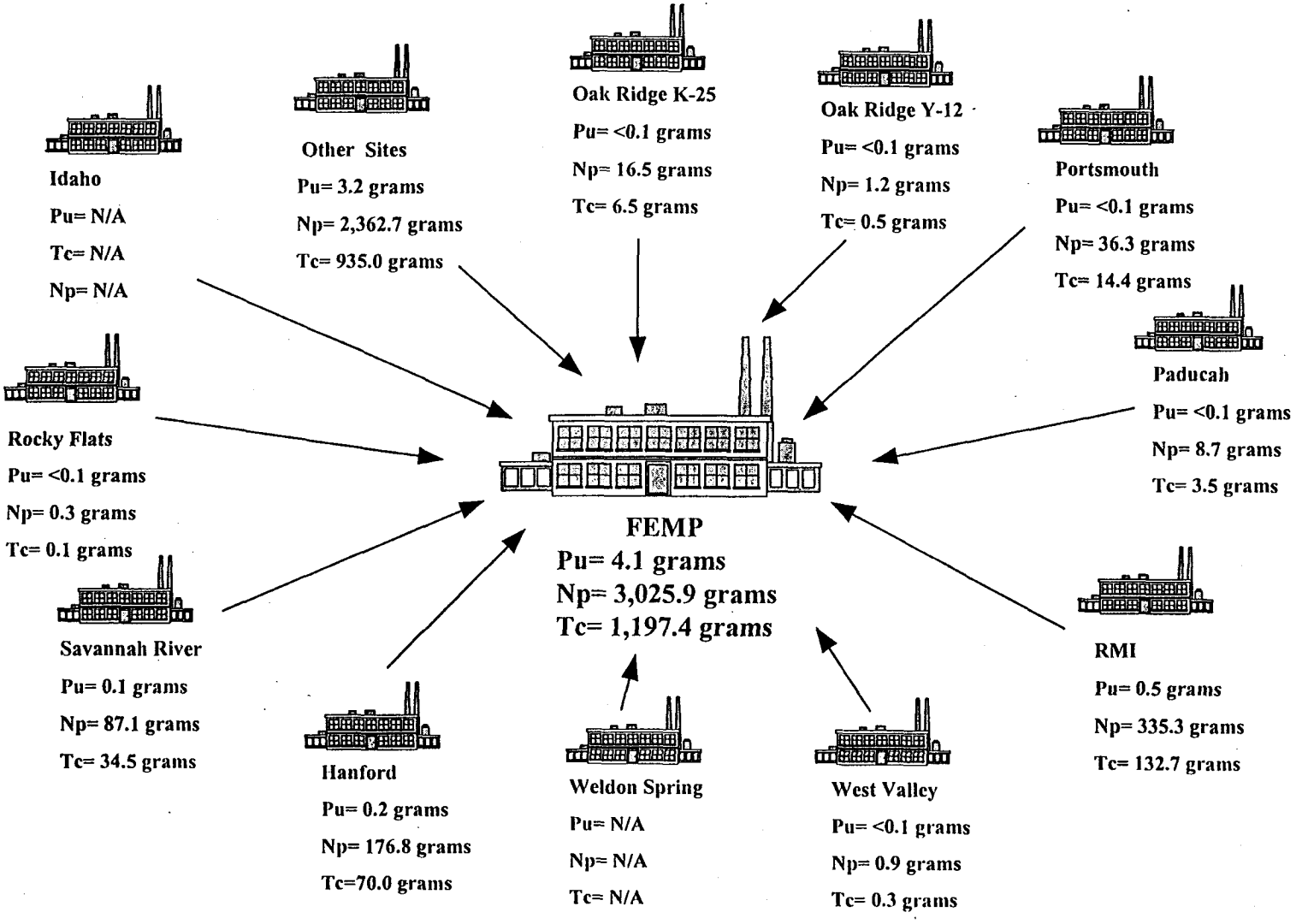
## CONSTITUENT MASS IN FEMP RECEIPTS – ENRICHED URANIUM




FER\URANIUM\FIGURES\FIGF5-1A.PPT\May 18, 2000 3:02 PM

## FIGURE F.5-1B

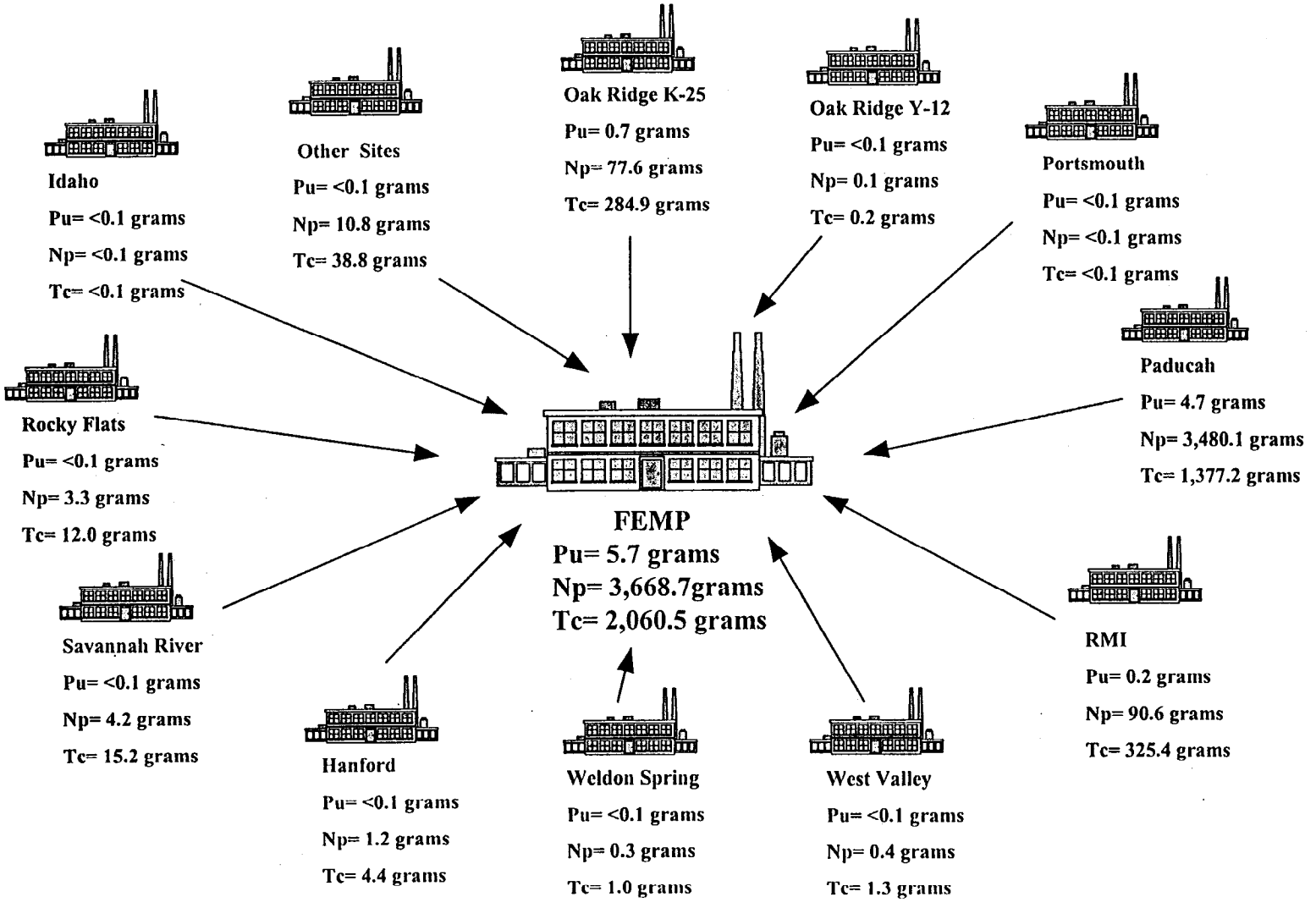
## CONSTITUENT MASS IN FEMP RECEIPTS – NORMAL URANIUM




FER\URANIUM\FIGURES\FIGF5-1B.PPT\May 13, 2000 3:40 PM

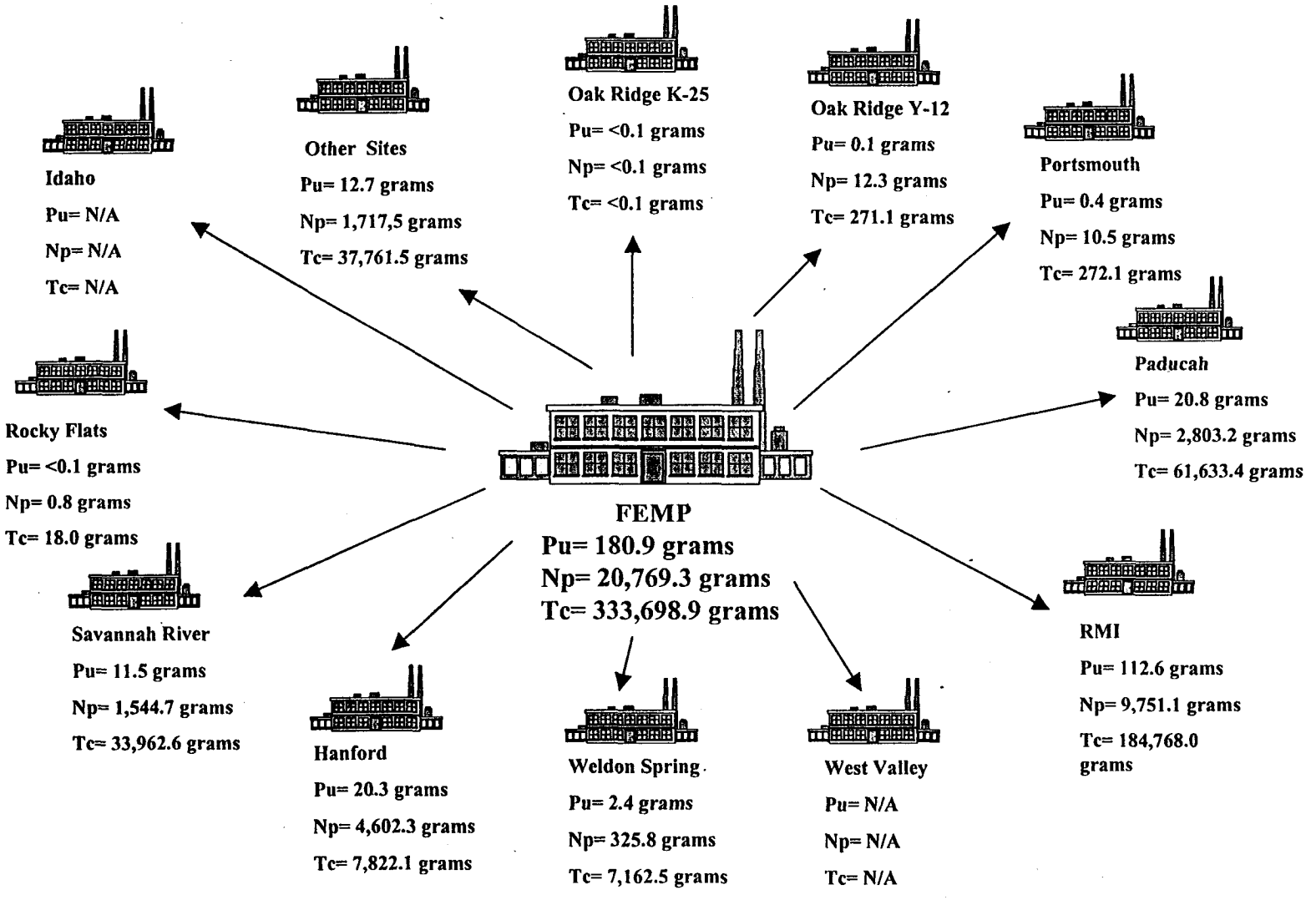
# FIGURE F.5-1C

## CONSTITUENT MASS IN FEMP RECEIPTS – DEPLETED URANIUM



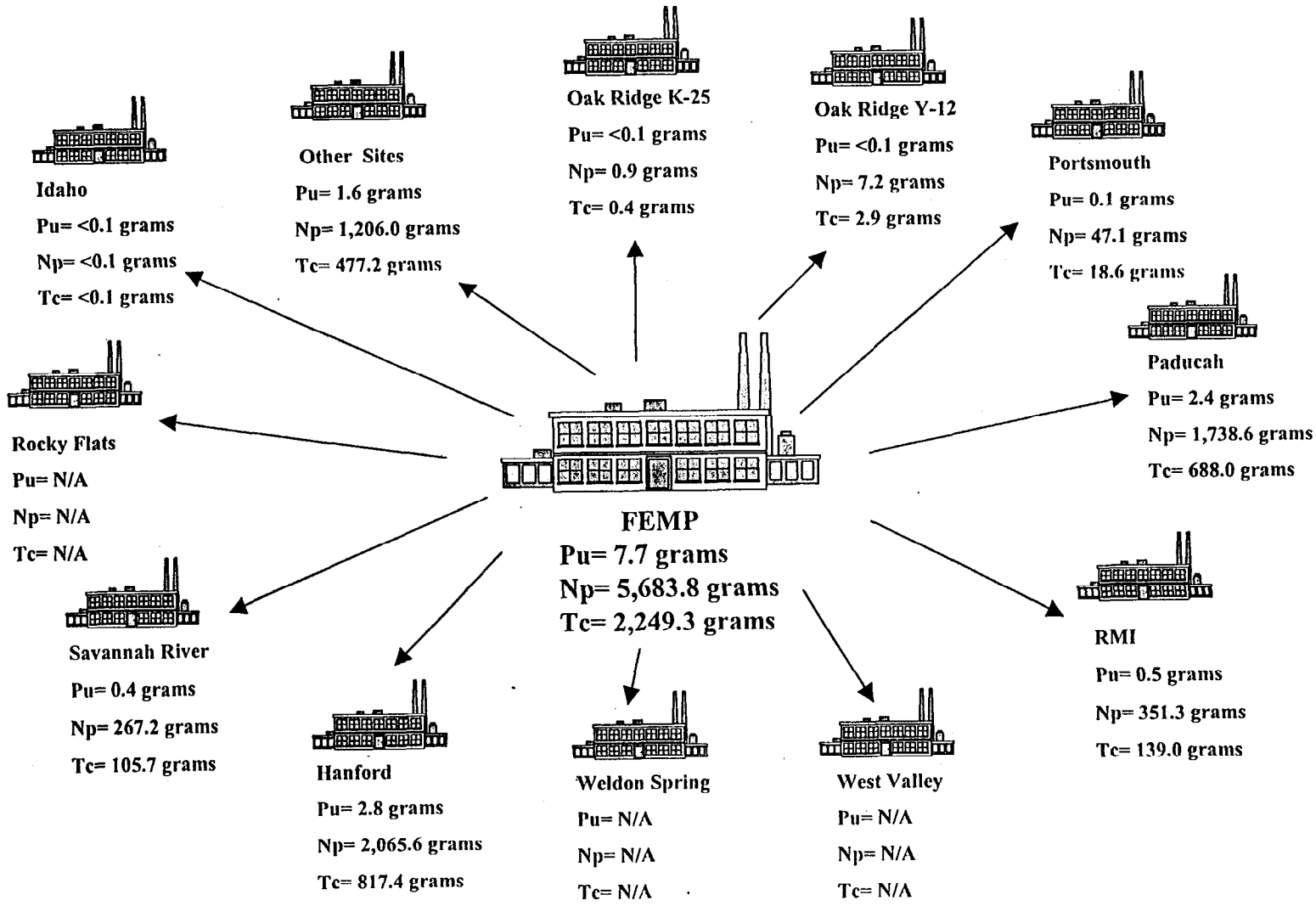
# FIGURE F.5-1D

## CONSITUTENT MASS IN FEMP SHIPMENTS – ENRICHED URANIUM



## FIGURE F.5-1E

## CONSITUTENT MASS IN FEMP SHIPMENTS – NORMAL URANIUM



## FIGURE F.5-1F

## CONSITUTENT MASS IN FEMP SHIPMENTS – DEPLETED URANIUM